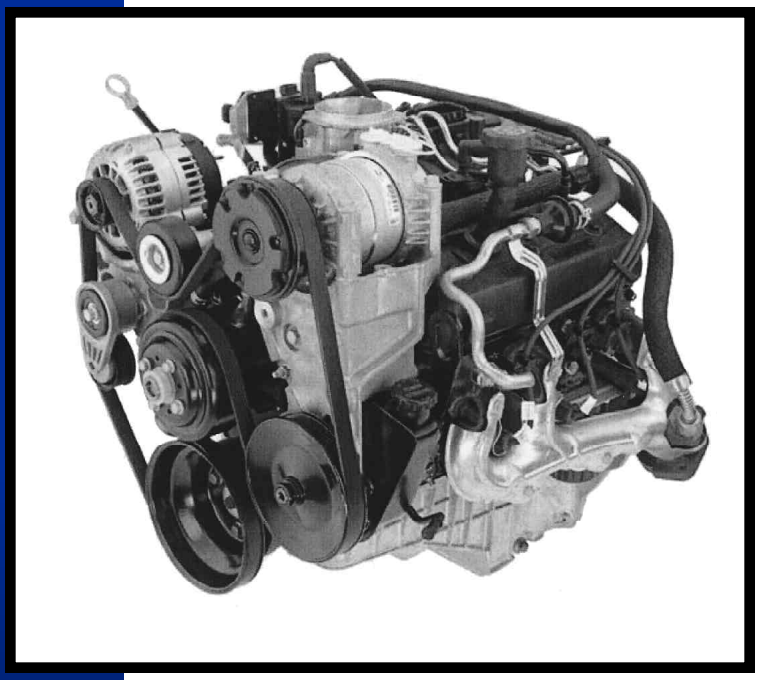
GM POWERTRAIN

# Application Manual



## Gasoline 4.3L
## V6 90 Degree
## 2001 Model Year

General Motors
Powertrain Group

# ENGINE APPLICATION MANUAL

## Gasoline 4.3L V6 90 Degree
## Engines RPO : L35

**Model Year: 2001**

**General Motors Powertrain Group**
**895 Joslyn Ave**
**MC: 480-710-225**
**Pontiac MI 48340**

# 1.0 INTRODUCTION

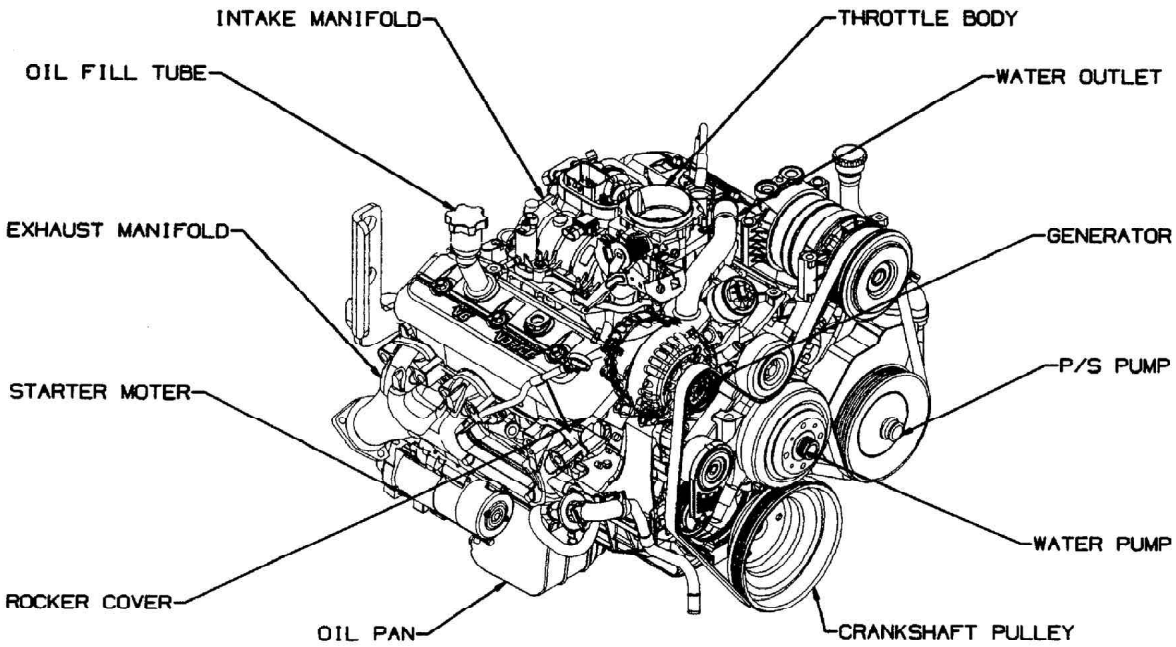
This manual assists the reader in the application of the 4.3L V6 90 Degree family of engines to Transportation Vehicles, Marine and Industrial applications. It gives an overview of the engine, its features, and systems. Details are provided on typical interfaces between the engine, related subsystems, and the vehicle.

**Caution:**
The performance of the engine is dependent on the specific application. It is recommended that the owner of this document be contacted before specific application decisions are made.

# 2.0 PRODUCT SUMMARY

## 2.1 APPEARANCE

The figure 2.1-I shows the 4.3L V6 90 Degree Engine.




**L35 Isometric View**

Figure: 2.1-I

## 2.2 FEATURES

The model year 2001 for 4.3L V6 90 Degree Engine has one version: L35.
This Engine has specific values of power and torque, which allow for a very wide range of application up to 15000 Lbs. GVW.

The more distinctive common features of this family of engines are:
-Optimized Intake Manifold
-Stiff Oil Sump
-High reliability and durability
-OBDII compliant

## 2.3 PRODUCT SPECIFICATION SUMMARY

### 2.3.1 SPECIFICATION

| ENGINE | L35 Truck Application | L35 Marine Application | UNITS |
|---|---|---|---|
| **PERFORMANCE** | | | |
| Rated Power | 200 | 223 | hp |
| Rate Power Speed | 4600 | 4800 | rpm |
| Rated Torque | 260 | 275 | Lb. ft |
| Rated Torque Speed | 2800 | 3800 | rpm |
| Torque Extension Speed Range | | | |
| (From Peak Torque to Peak Power) | 1800 | 1000 | rpm |
| Exhaust Restriction at Rated Power (Better than) | 8.85 to 8.58 @ 4600 rpm | 0 | in hg Piezometer |
| Inlet Restriction at Rated Power w/Filter | -0.89 @ 4600 rpm | 0 | in hg Piezometer |
| Redline Speed | 5000 | 5000 | rpm |
| Fuel Cut-Off Speed, Nominal Conditions | 5200 | 5200 | rpm |
| Fuel Cut-Off Speed, Cold Conditions | 5200 (-40) | 5200 (-40) | rpm |
| Maximum Upshift Speed | 5100 Man - 5200 Auto | N/A | rpm |
| Minimum Idle Speed | 525 | 650 | rpm |
| Minimum Unassisted Start Temperature | -20 | -20 | Degree C |
| **PHYSICAL/CONTENT** | | | |
| Type: | 4 Cycle | 4 Cycle | |
| Service Type | Naturally Aspirated | Naturally Aspirated | |
| Configuration: | V | V | |
| Bank Angle: | 90 | 90 | Degree |
| Number of Cylinders: | 6 | 6 | |
| Valvetrain Configuration: | OHV | OHV | |
| Number of Valves per Cylinder: | 2 | 2 | |
| Displacement: | 4302 | 4302 | cc.cm |
| Bore: | 101.6 | 101.6 | mm |
| Stroke: | 88.4 | 88.4 | mm |
| Compression Ratio: | 9.4:1 | 9.4:1 | |
| Firing Order: | 1-6-5-4-3-2 | 1-6-5-4-3-2 | |
| Rotational Direction: | CW | CW | |
| Fuel Injection Pump | Electronic | Electronic | |
| Certification | Federal & California | N/A | |
| Engine Mass | 200 | 200 | Kg |
| Spark Plugs | 41-932 (0.060”) | 41-932 (0.060”) | |
| Oil Filter | PF-52 | PF-52 | |
| Controller | Electronic | Electronic | |
| **SubSystems** | | | |
| **Air Intake Subsystem** | | | |
| Throttle Body Type | SCPI Sequential Central Port Injection | SCPI Sequential Central Port Injection | |
| Max Air Flow Rate: | 158@ 4600 rpm | 158@ 4600 rpm | Gr/sec |
| Intake manifold : | Symmetrical Runner | Symmetrical Runner | |
| Lower Intake: | Aluminum | Aluminum | |
| Upper Intake: | Composite | Composite | |

| ENGINE | L35 Truck Application | L35 Marine Application | UNITS |
|---|---|---|---|
| **Cylinder Head Subsystem** | | | |
| **Cylinder Head** | | | |
| Material | Cast-Iron GM232-M | Cast-Iron GM232-M | |
| Cylinder Head Type: | OHV | OHV | |
| Valves Actuation: | Push Rod | Push Rod | |
| Rocker Arm Ratio | 1.5:1 | 1.5:1 | |
| **Valve Train** | | | |
| Valves per Cylinder: | 2 | 2 | |
| Valves Angle from Vertical: | 15 | 15 | Degree |
| Lifters - Type | Hydraulic Roller | Hydraulic Roller | |
| Valve Guides | Cast Iron | Cast Iron | |
| **Intake Valves** | | | |
| Material | 1541 Steel | 1541 Steel | |
| Head Diameter | 49.3 | 49.3 | mm |
| Stem Diameter | 7.965 | 7.965 | mm |
| Length | 123.68 | 123.68 | mm |
| Seats | 45 Degree | 45 Degree | |
| Lift | 11.2 | 11.2 | mm |
| **Exhaust Valves** | | | |
| Material | 21 - 4N Stainless Steel with | 21 - 4N Stainless Steel with | |
| 3140 Welded Tip | 3140 Welded Tip | | |
| Head Diameter | 38.1 | 38.1 | mm |
| Stem Diameter | 7.965 | 7.965 | mm |
| Length | 124.84 | 124.84 | |
| Seats | 45 Degree | 45 Degree | |
| Lift | 11.0 | 11.0 | mm |
| **Main Block Subsystem** | | | |
| **Block Assembly:** | | | |
| Material | Cast-Iron GM232-M | Cast-Iron GM232-M | |
| Cylinders | Cast Iron | Cast Iron | |
| Lower Structure | Four main bearing Supports | Four main bearing Supports | |
| Bore Spacing | 111.76 | 111.76 | mm |
| Deck Height | 234.7 | 234.7 | mm |
| **Connecting rods:** | | | |
| Material - | Forged-SAE 1141 | Forged-SAE 1141 | |
| Length - | 154.9 | 154.9 | mm |
| Bolts | 9 | 9 | mm |
| Bearings | Aluminum Tin Silicon Alloy | Aluminum Tin Silicon Alloy | |
| Rod Length to Stroke Ratio | 1.68:1 | 1.68:1 | |
| **Piston** | | | |
| Type - | Strutless Flat Top | Strutless Flat Top | Cam Turned |
| Material - | Eutectic Cast Aluminum Alloy | Eutectic Cast Aluminum Alloy | |
| Weight | 437 | 437 | Gr |

| ENGINE | L35 Truck Application | L35 Marine Application | UNITS |
|---|---|---|---|
| **Piston Pins** | | | |
| Type - | Fixed 24X70 | Fixed 24X70 | mm |
| Material - | Steel SAE 1019 | Steel SAE 1019 | |
| **Piston Rings** | | | |
| Compression Rings Number: | 2 | 2 | |
| Top Compression | Steel Barrel 1.5mm | Steel Barrel 1.5mm | |
| Second Compression | Cast Iron 1.5 mm | Cast Iron 1.5 mm | |
| **Oil Control Rings Number -** | 1 | 1 | |
| Type - | Low Tension 3 Pieces | Low Tension 3 Pieces | |
| Material - | Plated Steel | Plated Steel | |
| **Camshaft** | | | |
| Material - | 5150 Steel Billet | 5150 Steel Billet | |
| Description | Gun Drilled | Gun Drilled | |
| Base Circle Diameter: | 39.4 | 39.4 | Mm |
| Drive Chain Pitch Roller | 3/8 | 3/8 | |
| Camshaft Valve Timing: | | | |
| Intake Valve.....Opens | -33 BTDC | -33 BTDC | Crk Degree |
| Closes | 286 ATDC | 286 ATDC | Crk Degree |
| Exhaust Valve.....Opens | -271 BTDC | -271 BTDC | Crk Degree |
| Closes | 48 TDC | 48 TDC | Crk Degree |
| Camshaft Bearings | Steel Backed Copper/Lead | Steel Backed Copper/Lead | |
| **Valve Springs** | | | |
| Material | Super Clean Cr-Si | Super Clean Cr-Si | |
| Type | Double Shot Peened | Double Shot Peened | |
| Dimension | 4.6 mm Round | 4.6 mm Round | |
| Closed (Valve Closed) | 356 | 356 | Newtons |
| Open (Rate) | 65 | 65 | Newtons/mm |
| **Crankshaft** | | | |
| Material - | Cast Nodular Undercut Rolled Fillet | Cast Nodular Undercut Rolled Fillet | |
| Number of Counterweights | 6 | 6 | |
| Main Journal Diameter - | 62.2 | 62.2 | Mm |
| Crank Pin Journal Diameter | 57.1 | 57.1 | Mm |
| Bearings | Aluminum Tin Silicon Alloy | Aluminum Tin Silicon Alloy | |
| Torsional Damper | Ring Inertia | Ring Inertia | Rubber Mounted |
| Crankcase Ventilation | Negative Closed (Vacuum created from Intake Manifold) | Negative Closed (Vacuum created from Intake Manifold) | |

| ENGINE | L35 Truck Application | L35 Marine Application | UNITS |
|---|---|---|---|
| **Balance Shaft** | | | |
| Type | First Order | First Order | |
| Material | Nodular Cast | Nodular Cast | |
| Rotation | CCW | CCW | |
| Speed | Same as Crank. | Same as Crank. | |
| Drive | Helical Gear 14 ° Off Cam | Helical Gear 14 ° Off Cam | |
| **Oil Lubrication** | | | |
| Main and Rod Bearings | Pressure | Pressure | N/a |
| Camshaft | Pressure | Pressure | N/a |
| Timing Gear | Splash | Splash | N/a |
| Connecting Rods | Pressure | Pressure | N/a |
| Valve Mechanism | Pressure | Pressure | N/a |
| Cylinder Walls | Splash | Splash | N/a |
| Piston & Pins | Splash | Splash | N/a |
| Cylinder Head | Hollow Push Rod | Hollow Push Rod | N/a |
| **Oil Capacity** | | | |
| Oil | 5W-30W Mineral | 5W-30W Mineral | N/a |
| W/ Filter | 4.5 | 4.5 | Qts |
| W/o Filter | 4.0 | 4.0 | Qts |
| **Oil Filter** | | | |
| Type | Full Flow PF-47 | Full Flow PF-47 | N/a |
| Capacity | 0.3 | 0.3 | Qts |
| **Oil Pump** | | | |
| Type | Spur Gear | Spur Gear | N/a |
| Normal Pressure | 40-45 psi | 40-45 psi | @ 2000 RPM |
| Idle Pressure | 20-25 psi | 20-25 psi | @ Idle |
| Oil Flow @ 1000 RPM | 2 | 2 | GPM |
| Drive | Camshaft | Camshaft | N/a |
| **Fuel Injection System** | | | |
| Mean Features | | | |
| Injection Pump Make | Delphi | Delphi | |
| Type | Top Feed | Top Feed | |
| Model | SCFI | SCFI | |
| Injection Timing | Sequential | Sequential | |
| Operating Pressure | 425 +/- 9 | 425 +/- 9 | KPa |
| Opening Pressure | 285 +/- 9 | 285 +/- 9 | KPa |
| Fuel Pump | | | |
| Fuel Pump Make | Delphi | Delphi | |
| Type | 44MM -G-Rotor | 44MM –G-Rotor | |
| Minimum Fuel Flow | 25 | 25 | Gram/Sec |
| Maximum Fuel Flow | TBD | TBD | Gram/Sec |
| Fuel Pump Voltage Range | 6-12 | 6-12 | Volts |
| Fuel Pump Pressure | 425 | 425 | Kpa |
| Fuel Filter | Delphi | Delphi | |
| Type | Full Recirculation | Full Recirculation | |
| Material | Nylon 66 | Nylon 66 | |

| ENGINE | L35 Truck Application | L35 Marine Application | UNITS |
|---|---|---|---|
| Regulator | Delphi Cartridge | Delphi Cartridge | |
| Nominal Pressure | 425 | 425 | Kpa |
| Injectors | Delphi | Delphi | |
| Recommended Fuel | 87 | 87 | Octane = (R+M)/2 |
| Water Pump Type: | Centrifugal | Centrifugal | |
| Water Pump Maximum Flow @ Engine RPM: | 76.5 | 76.5 | GPM @ 4600 RPM |
| Maximum Sustained Coolant Temperature: | 262 | 262 | F |
| Thermostat Setting | | | |
| Starts to Open | 180 | 180 | F |
| Full Open | 262 | 262 | F |
| Bearing Type | Ball/Roller | Ball/Roller | |
| Impeller Material | Cast iron | Cast iron | |
| Housing Material | Cast iron | Cast iron | |
| By Pass Recirculation Type | External | External | |
| Water Jackets full length of Cylinder | Yes | Yes | |
| Water Jackets all around Cylinder | Yes | Yes | |
| Water Jackets open at head face | No | No | |
| Surge Tank System | No | No | |
| Coolant Fill LocationDeaeration Tank | Deaeration Tank | | |
| Circulation Thermostat Type | Bypass | Bypass | |
| - direction of rotation : | CCW | CCW | |
| - drive ratio (relative to crankshaft) | 1.25 | 1.25 | |

### 2.3.2 Fuel Requirements

The 4.3L V6 90 Degree Engine System meets the emissions standard established in the FMVS and EPA regulations with fuel quality in accordance with the API standards.

The engine must operate on the following types of fuels:
Unleaded Gasoline 87 (R+M)/2 (ASTM D4814),
Unleaded Gasoline 87 (R+M)/2 with up 15 % MTBE (Methyl Tertiary-Butyl Ether),
Canadian Gasoline 87 (R+M)/2 (CGSB 3.5-92) w/ MMT @ 18 mg/L manganese,
Reformulated Gasoline,
Premium Unleaded 91 (R+M)/2,
Export Gasoline as low as 80 (R+M)/2,
South American Gasoline with Peroxide contamination to 2.5%
Methanol mixes with gasoline to 15 %,
Ethanol mixes with gasoline to 25 %, Brazilian fuel system (SCPI) required.
Leaded Gasoline. Special cylinder heads required- NM8

## 2.3.2 Performance

### 2.3.2.1 Engine Power & Torque

The performance of the 4.3L V6 Engine is specified in the following paragraphs.

The Fig 2.3.2.1-I shows the following performance characteristics for the L35 engine: Power, Torque and Speed Range.

The engine will deliver the power and torque levels within +/-5% (after run in) as shown in Table 2.3.2-I.

| RPM | Truck Applications | | Marine Applications | | Industrial Applications | | Notes |
|---|---|---|---|---|---|---|---|
| | Power HP | Torque Lbs.-ft | Power HP | Torque Lbs.-ft | Power HP | Torque Lbs.-ft | |
| 800 | 32.4 | 210.4 | 35.7 | 233.5 | N/A | N/A | |
| 1200 | 50.7 | 221.9 | 57.0 | 248.6 | 35 | 200 | |
| 1600 | 72.6 | 238.1 | 78.7 | 257.7 | 60 | 210 | |
| 2000 | 93.8 | 246.1 | 99.1 | 260.2 | 80 | 220 | |
| 2400 | 116.3 | 254.3 | 120.3 | 262.5 | 105 | 230 | |
| 2800 | 137.9 | 258.2 | 143.4 | 269.1 | 118 | 220 | |
| 3200 | 157.5 | 257.9 | 166.4 | 272.7 | 120 | 210 | |
| 3600 | 174.7 | 254.4 | 188.2 | 274.1 | 119 | 200 | |
| 4000 | 188.5 | 247.1 | 206.2 | 270.2 | 118 | 190 | |
| 4400 | 195.8 | 233.0 | 217.6 | 259.5 | N/A | N/A | |
| 4600 | 198.1 | 226 | 220.8 | 252.0 | N/A | N/A | |
| 4800 | 197.8 | 216.3 | 221.6 | 242.3 | N/A | N/A | |
| 5200 | 192.3 | 194.2 | 216.0 | 218.0 | N/A | N/A | |

Fig 2.3.2.1 -I 4.3L V6 Engine Power & Torque

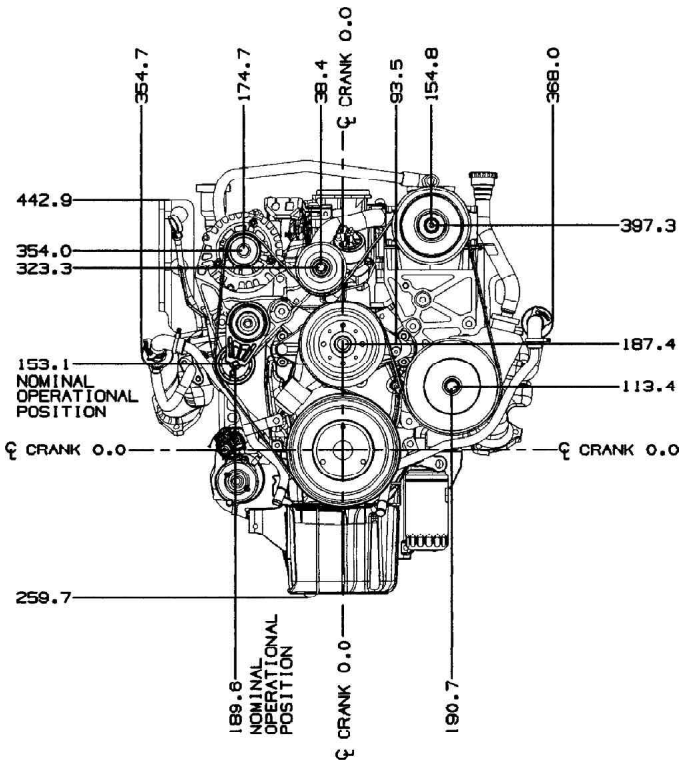
Test Conditions for Truck Applications
* Based on the following conditions (measured at maximum rated speed W.O.T):
-Exhaust restriction 8.5” of Hg
-Air Intake temperature 77° F
-Intake restriction - 1” of Hg
-SAE J1349

Test Conditions for Marine & Industrial Applications
* Based on the following conditions (measured at maximum rated speed W.O.T):
-Exhaust restriction: 0 of Hg
- Air Intake temperature: 77 ° F
-Intake restriction - 1” of Hg
-GMPT Test #20
-This data reflects the Maximum values obtained with Different Intakes Manifolds & Fuel Systems

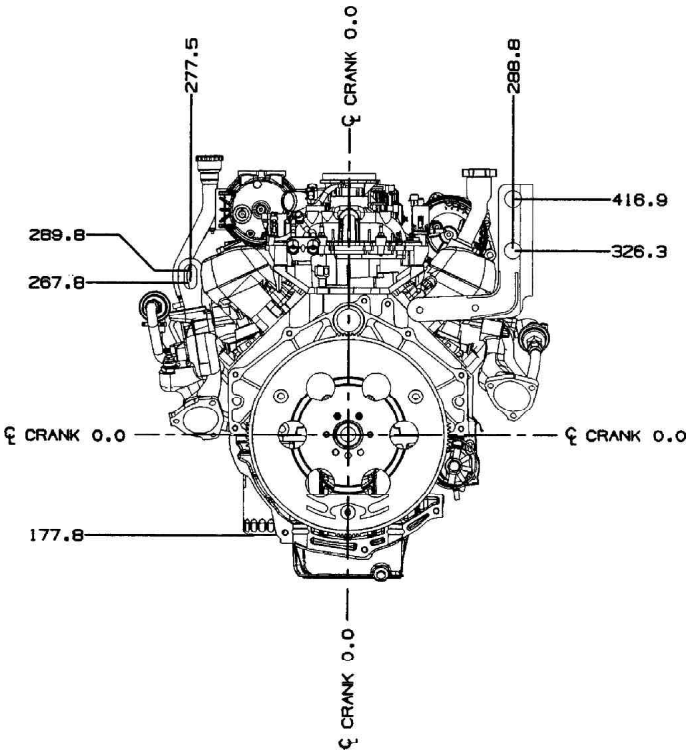
## 2.4 FEATURE LOCATION ILLUSTRATIONS

Front, Rear, Rh and Lh views of the 4.3L V6 90 Degree are included here with its overall dimensions for preliminary packaging evaluations.

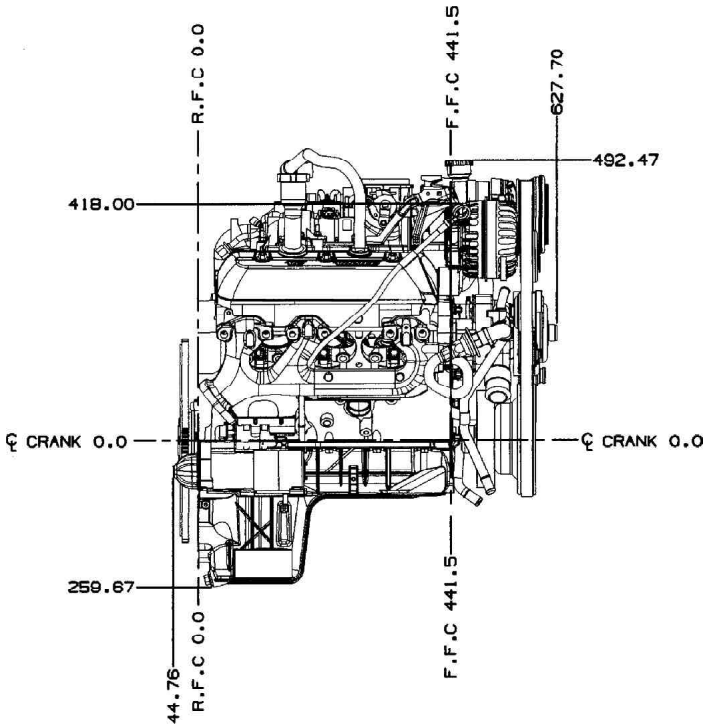
# L35 Main Views



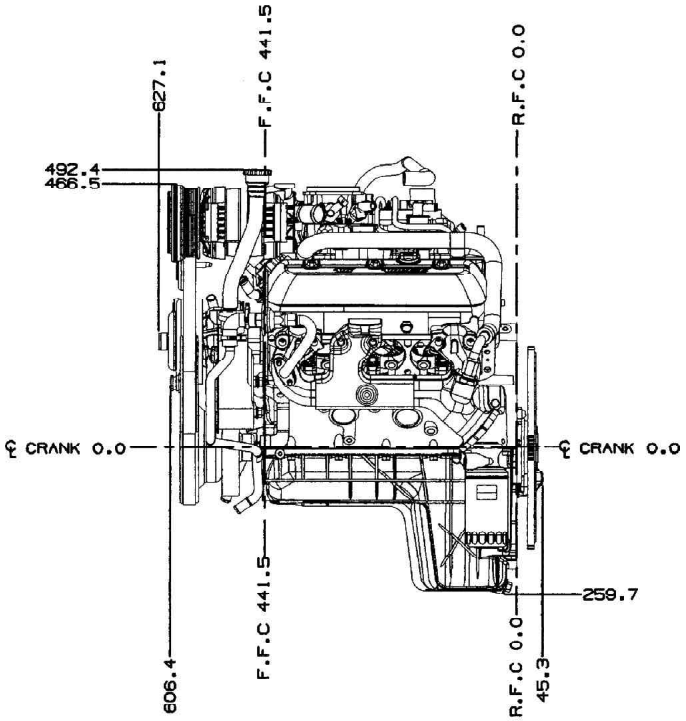

# L35 Front View




# L35 Rear View




**L35 RH Side View**




**L35 LH Side View**

## 2.5 CONFIGURATION AS SHIPPED

### 2.5.1 Engine as Shipped

Engine as shipped from the engine plant is to conform to a common state of dress as described below. The following components are installed at the engine plant:

Harmonic balancer
Direct drive accessories (not belt driven)
Engine lift brackets
Engine oil dipstick and tube
Exhaust manifold heat shields (As required)
Heater hose nipples
Manifold air pressure sensor
Oil filter (except remote mounted)
Water pump
Crankshaft sensor
E.G.R. system
Engine oil
Exhaust manifold(s)
Engine Fuel system
Coolant temperature sensor/switch
Oil pressure sensor/switch
Transmission alignment dowels
Flywheel and or Flexplate
Crankcase ventilation system

## 2.6 IDENTIFICATION AND MARKING

### 2.6.1 VIN Identification Labeling

There are two places for the stamping of the V.I.N.: one is provided side by side on the left hand side of powertrain and the other is in rear face of cylinder case.

### 2.6.2 Emissions Certification Labeling

A vehicle emission control label that meets the format and content requirements of Federal Regulation 40 CRF 86.095-35 and CARB Regulation Title XIII California Code of Regulations Section 1965 shall be attached to the vehicle subsystem in the location required by the regulations above.
Incomplete Vehicles manufactured in two or more stages shall meet the certification labeling requirements of the regulations above.
Emissions Certification is not provided for Marine Industrial Applications.

### 2.6.3 Engine Identification - Broadcast Codes

The 4.3L V6 Engine has an identification number cast into the cylinder case front LH side. Also, an Engine Verification Label is applied to the rear of the left bank cylinder head. This is the single label location for passenger car engines. In addition to the LH rear head location, the truck engines have another identical label applied to the oil pan (near the bottom of the engine) on the right side.
The labels show the following information:

- First Two characters: 10 - Indicates an engine not a transmission.
- Next 3 characters: Broadcast code (engine configuration which includes a cross reference to model year of build):
  - Model year (1st letter)

characters: Julien Date of Build

- Last 4 Characters: Sequence number of build on that date.

Translated the engine verification number shown in the sample label below identifies an engine, broadcast code (XJB) (1999 5.3L Federal Auto), built at Romulus on February 10 , 1999; sequence number 1034.

**Example: * 10XJB W990411034***

### 2.6.3.1 Engine Option Description

| RPO | Description | Notes |
|---|---|---|
| L35 | 4.3L V-6 Engine w/ SCPI | |
| M30/MT1 | Automatic Transmission | |
| M50/MG5 | Manual Transmission | |
| K18 | Air Injection (Electric pump) | |
| KC4 | Engine Oil Cooler | |
| KL5 | Gaseous Fuel Compatible | |
| NA1 | Below 8500# GVW | |
| NA3 | Emission System - Japan | |
| NA4 | Above 8500# GVW | |
| NB6 | Emission System - Calif. | Tier 1 (-K18 on CK Manuals) |
| NC1 | Emission System - Calif. LEV | (+K18 on CK / -K18 on M/L) |
| NC8 | Emission System - Calif. ULEV | (-K18 on ML) |
| NF2 | Emission System - Federal Tier 1 | (-K18 on CK & P) |
| NF4 | Emission System - Clean Fuel Fleet | |
| NF7 | Emission System - Federal N LEV | |
| NM2 | Emission System - Leaded Fuel | (Export for ML & P) |
| NM8 | Leaded Fuel System Compatible | (Export for ST) |
| NN8 | Emission Override - Unleaded Fuel | (Export) |
| NW7 | Traction Control | |
| RHD | Right Hand Drive | |
| S5I | Brazil Equipment | |
| W99 | Venezuela Equipment | |
| TZ0 | Mexican Equipment | (Manual Transmission) |
| ZK3 | G-Van Pull Ahead | (Vehicle only) |

### 2.6.3.2 Engine Broadcast Codes & Part Numbers

| Part Number | TON | ROM | Broad Cast Code | Vehicle | Description |
|---|---|---|---|---|---|
| 12559672 | X | | AAA | CK | L35+M30+NF2 (-K18) |
| 12559676 | X | | AAF | CK | L35+M30+NC1 (+K18) |
| 12559673 | X | | AAB | CK | L35+MG5+NF2 (-K18) |
| 12559677 | X | | AAH | CK | L35+MG5+NC1 (+K18) |
| | | | | | |
| 12559680 | | X | ABA | G-LD | L35+M30+NA1-K18 |
| 12559681 | | X | ABB | G-HD | L35+MT1+NA4 (-K18) |
| 12559682 | | X | ABC | G-LD | L35+M30+NA1+NF4+K18 |
| | | | | | |
| 12559684 | X | | ACA | ML | L35+M30+NA3/NC1/NC8/NF2/NF4/ NF7 |
| 12559685 | | X | ACB | ML | L35+M30+NM2 |
| | | | | | |
| 12559687 | | X | ADA | P | L35+MT1+NF2-KL5 |
| 12559688 | | X | ADB | P | L35+MT1+KL5+NF2 |
| | | | | | |
| 12559691 | X | X | AFC | S | L35+M30-K18-NM8 (+NN8) |
| 12559707 | | X | AFL | S | L35+M30+NM8 |
| 12559692 | X | X | AFD | S | L35+M50-K18-NM8 (+NN8) |
| 12559708 | | X | AFN | S | L35+M50+NM8 |
| 12559701 | X | X | AFJ | S | L35+M30+K18+NF4 |
| 12559702 | X | X | AFK | S | L35+M50+K18+NF4 |
| | | | | | |
| 12559695 | X | X | AHC | T | L35+M50-K18-NM8-RHD |
| 12559696 | X | X | AHD | T | L35+M30-K18-NM8-RHD |
| 12559709 | | X | AHP | T | L35+M50+NM8-W99 |
| 12559710 | | X | AHS | T | L35+M50+W99+NN8 |
| 12560378 | | X | AHX | T | L35+M30+RHD-NM8-K18 |
| 12560379 | | X | AHY | T | L35+M50+RHD-NM8-K18 |
| 12559711 | | X | AHT | T | L35+M30+NM8 |
| 12559705 | X | X | AHL | T | L35+M30+NF4+K18 |
| 12559706 | X | X | AHN | T | L35+M50+NF4+K18 |
| | | | | | |
| 12560483 | X | | 1LB | —- | Marine (Volvo) 2Bbl w/Dist. |
| 12560485 | X | | 1LJ | —- | Marine (Merc) 2Bbl w/o Dist. |
| 12560484 | X | | 1LC | —- | Marine 4Bbl w/ Dist. |
| 12560486 | X | | 1LK | —- | Marine 4Bbl w/o Dist. |
| 12560481 | X | | 1LT | —- | Indust 2Bbl Gaseous - Bucks Irrigation |
| 12560482 | X | | 1LX | —- | Indust 2Bbl Gas - Williams Powertrain |
| 12559712 | | X | 1LA | T | L35+M50+S5I (Brazil) |
| 12559713 | | X | 1LD | T | L35+M30+S5I (Brazil) |
| | | | | | |

# 3.0 GMPT SYSTEM INTERFACES

## 3.1 INTERNAL INTERFACES TO GMPT

### 3.1.1 Engine Interface to transmission

The transmission shall be attached to the rear end of the engine, which provided the flange face attachment illustrated in the figure 3.1.1- I.

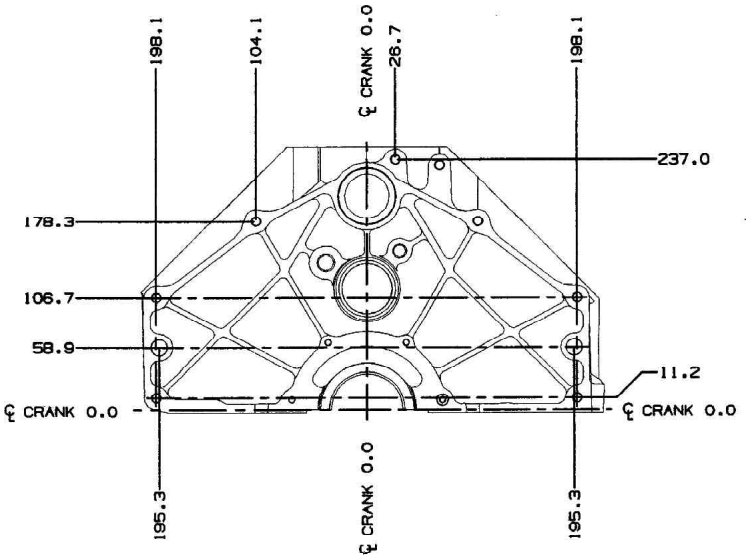



Figure 3.1.1-I: Transmission attachment

#### 3.1.1.1 Automatic Transmission

The 4.3L V6 engine could be mated to either: the GM Automatic Transmission Hydra Matic 4L60E or the GM Automatic Transmission Hydra Matic 4L80E
Figure 3.2.1-I to 3.2.1-XVIII shows the PCM Engine to Automatic Transmission Mechanization Diagram.

#### 3.1.1.2 Manual Transmission and Clutch

The GM Manual Transmission recommended is a Five Speed Manual (MW 3)
The following engine-transmission, clutch interface issues must be considered:
Manual transmissions require the engine crankshaft pilot bearing to be able to support up to 920 lbs (4292 N) of radial load due to transmission internal gear forces.

The following table shows the different Transmissions and Components coupled to the L35 engine and GM platforms.

| Transmission ( UPC: 7 ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Auto 4L80E MT1 | 24210752 | N/A | 24210754 | N/A | N/A |
| Bolt/Screw/Stud | 15724226<br>11514224 | N/A | 15724226<br>11514224 | N/A | N/A |
| Auto 4L60E M30 | N/A | 24211665<br>24211666<br>24211667 | 24211668 | 24211663<br>24211664 | 24211662<br>24211663 |
| Brace | N/A | N/A | N/A | 15992466 | N/A |
| Bolt/Screw/Stud | N/A | 11515768<br>15724226 | 11515768<br>15724226 | 15724226<br>11517000<br>25624806 | 11517000<br>1261968 |
| Manual 5-Speed MW3 | 15020892 | N/A<br>15031131 | N/A | N/A | N/A |
| Bolt/Screw/Stud | 11514224 | N/A | N/A | N/A | N/A |
| Manual 5-Speed MG5 | N/A | 15769087<br>15769088 | N/A | N/A | N/A |
| Bolt/Screw/Stud | N/A | 11515768 | N/A | N/A | N/A |
| Manual 5-Speed MW2 | N/A | N/A | N/A | N/A | 15045050 |
| Bolt/Screw/Stud | N/A | N/A | N/A | N/A | 11515768 |
| Manual 5-Speed M50 | N/A | N/A | N/A | N/A | 15769696<br>15769697<br>15769698 |
| Bolt/Screw/Stud | | | | | 11517000 |

### 3.1.2 Engine Interface to PCM ( Vehicular and Marine/Industrial Application)

The 4.3L V6 90 Degree Engine uses the Powertrain Control Unit (PCM) to control the engine, automatic transmission, the vehicle performance parameters and the onboard diagnostic system.

#### 3.1.2.1 Inputs from the Engine to the PCM

The following Inputs are internal engine parameters and must be supplied to the Powertrain Control Module:
Barometric Pressure (Or Manifold Absolute Pressure) - POA Engine Assembly
Mass Airflow Sensor (Air Cleaner/Air Duct)
Engine Speed
Crankshaft Sensor and Camshaft Sensor
Knock Sensor
Air intake Temperature Sensor (POA MAF) - (Only for the GMT-800 Truck)
Engine Coolant Temperature ECT Sensor-POA Engine Assembly
Engine Oil Pressure Sensor

#### 3.1.2.2 Outputs from PCM to the Engine

Fuel Injectors Management – (Injection Pulse Width Signal)
Idle Air Control Motor (IACV)
Ignition Control Coil Module
Linear EGR Valve Solenoid
Evap. System
Purge Solenoid
Secondary Air (AIR) System
A/C Control
Serial Data

### 3.1.3 PCM Interface to Transmission

The PCM uses an Electronic Transmission Control Algorithm to monitor and control the transmission. This algorithm is actually a combination of four algorithms, these algorithms monitor and control the various aspects of the transmission shifting.

#### 3.1.3.1 Input Algorithm:

The Input Algorithm samples all external sensors and scale these values.

#### 3.1.3.2 Shift Control Algorithm:

The Shift Control Algorithm determines which gear ratio the transmission is currently in and changes the state of the control solenoid to accomplish a shift.
The shift pattern is controlled by a set of tables. These contain the vehicle speed at which the shift is to occur as a function of throttle position.
In the manual mode, the current gear may be determined by the operator's movement of the gearshift selector lever.

#### 3.1.3.3 Shift Quality Algorithm:

The Shift Quality Algorithm determines shift quality (or firmness).
This is accomplished by controlling the pressure control solenoid, which regulates the torque signal modulation pressure.
This pressure is determined by a table that is based on vehicle speed and Throttle position.
Garage Shift quality (shifting from Park or Neutral to Drive or Reverse when the vehicle is stationary) is also controlled by torque signal pressure.

#### 3.1.3.4 TCC Control Algorithm

The TCC algorithm determines when the torque converter clutch is applied or released, using a set of tables. These tables also determine and control the rate of application and release of the TCC based on Throttle position

#### 3.1.3.5 Inputs from Transmission to PCM

The following are external Inputs coming from the Transmission to the PCM:
Transmission Speed Sensor
Transmission Fluid Temperature Sensor
Transmission Range Pressure Sensor

#### 3.1.3.6 Output to the Transmission from PCM

TCC Solenoid
Transmission Shift solenoids
Pressure Control Solenoid

### 3.1.4 PCM Interface to Vehicle

#### 3.1.4.1 External Inputs of the Engine

The following are external Inputs coming from the vehicle to the PCM:
A/C Status
Ignition Voltage
Serial Data (Diagnostics)
Brake/ Clutch Status
4WD Lo Switch (If Applicable)
Diagnostic Enable
Cruise Control Inputs
Tow/Haul Input Switch

#### 3.1.4.2 Output to the Vehicle:

Data link Connector
MIL “Service Engine Soon” Lamp
“Service Throttle Soon” (STS) Lamp

### 3.1.5a PCM Pin Out and Pin In – Truck Applications

See Figure 3.1.5 - I Powertrain Control Module Diagram to reference the following pin out and pin in connector information

ENGINE - BASE (GEN 1E L35 & M30/MT1)
PCM CONNECTOR CAVITY CHART
J1 (F) CONNECTOR

PCM CONNECTOR ASSY: 12191489
TPA (BLUE) 2 REQ'D: 12176408
COVER: 12191108

| CAVITY | FUNCTION | CIRCUIT/COLOR | USAGE Y | N | N. C. | CAVITY | FUNCTION | CIRCUIT/COLOR | USAGE Y | N | N. C. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| J1-01 | PWR GRD A | 451 BLK/WHT | Y | | | J1-41 | VREF RTN A | SEE APP DWG | Y | | |
| J1-02 | CRANK SENSOR SUPPLY | 1867 LT GRN | Y | | | J1-42 | FAN1 RELAY/ENG SHTDWN | SEE APP DWG | | N | |
| J1-03 | INJ H | 1746 PNK/BLK | | N | | J1-43 | INJ C | 877 RED/BLK | Y | | |
| J1-04 | INJ D | 1745 LT GRN/BLK | Y | | | J1-44 | INJ C | 844 LT BLU/BLK | | N | |
| J1-05 | FUEL TANK PRESS (SEC) | TBD | | N | | J1-45 | VREF SUP 2 A | 474 GRA | | N | |
| J1-06 | BHC CURRENT MONITOR | TBD | | N | | J1-46 | VREF SUP 2 B | 474 GRA | Y | | |
| J1-07 | VREF SUP 1 C | SEE APP DWG | | N | | J1-47 | VREF SUP 1 A | SEE APP DWG | Y | | |
| J1-08 | VREF SUP 1 D | SEE APP DWG | Y | | | J1-48 | VREF SUP 1 B | SEE APP DWG | Y | | |
| J1-09 | FLAT ODD HI | TBD | Y | | | J1-49 | FLAT ODD LO (SHIELD) | TBD | Y | | |
| J1-10 | FLAT EVEN HI | TBD | | N | | J1-50 | FLAT EVEN LO (SHIELD) | TBD | | N | |
| J1-11 | RES KNOCK 2 | 1876 LT BLU | | N | | J1-51 | RES KNOCK 1 | 496 DK BLU | | N | |
| J1-12 | CRANK 1 POS | 1869 DK BLU/WHT | Y | | | J1-52 | PTO STATUS | SEE APP DWG | | N | |
| J1-13 | REQUEST TORQ | 463 ORN/BLK | | N | | J1-53 | VREF RTN F | 497 BLK | Y | | |
| J1-14 | BTC SDATA A | SEE APP DWG | | N | | J1-54 | VREF RTN B | 469 ORN/BLK | Y | | |
| J1-15 | BTC SDATA B | SEE APP DWG | | N | | J1-55 | LEGR 1 POS | 1456 BRN | Y | | |
| J1-16 | CRANK 2 POS | TBD | | N | | J1-56 | FUEL COMPOSITION SEN | TBD | | N | |
| J1-17 | TRANS PSM B | 1225 DK BLU | Y | | | J1-57 | BATT B | SEE APP DWG | Y | | |
| J1-18 | TRANS PSM C | 1226 RED | Y | | | J1-58 | CLASS 2 SDATA A | 1849 GRN DK | Y | | |
| J1-19 | IGN 1 | *39 PNK | Y | | | J1-59 | CLASS 2 SDATA B | 710 YEL | | N | |
| J1-20 | BATT A | SEE APP DWG | Y | | | J1-60 | VREF RTN D | 452 BLK | Y | | |
| J1-21 | CRANK SEN RTN | 1868 YEL/BLK | Y | | | J1-61 | CAM SENSOR RTN | 632 PNK/BLK | Y | | |
| J1-22 | PTO ENAB SW | 488 GRN LT | | N | | J1-62 | EXTENDED BRAKE SW | TBD | | N | |
| J1-23 | VREF RTN H | SEE APP DWG | Y | | | J1-63 | VREF RTN C | SEE APP DWG | | N | |
| J1-24 | O2 F LO | TBD | | N | | J1-64 | O2 F HI | TBD | | N | |
| J1-25 | O2 D LO | 1671 TAN | | N | | J1-65 | O2 D HI | 1670 PPL | | N | |
| J1-26 | O2 B LO | 1667 TAN | Y | | | J1-66 | O2 B HI | 1666 PPL | Y | | |
| J1-27 | O2 E LO | TBD | | N | | J1-67 | O2 E HI | TBD | | N | |
| J1-28 | O2 C LO | 1669 TAN/WHT | Y | | | J1-68 | O2 C HI | 1668 PPL/WHT | Y | | |
| J1-29 | O2 A LO | 1653 TAN/WHT | Y | | | J1-69 | O2 A HI | 1665 PPL/WHT | Y | | |
| J1-30 | LOW CLT SW/SIG | SEE APP DWG | | N | | J1-70 | LOW OIL SW | 1174 BRN | | N | |
| J1-31 | HI IDLE SW | 534 GRN DK | | N | | J1-71 | PTO ENGINE KILL SW | 494 BLU LT | | N | |
| J1-32 | PRNDL A/CLUTCH SW | SEE APP DWG | | N | | J1-72 | PRNDL B | 772 YEL | | N | |
| J1-33 | TCC BRAKE SW | 420 PPL | Y | | | J1-73 | CAM SEN POS | 633 BRN/WHT | Y | | |
| J1-34 | PRNDL P/P-N SW | SEE APP DWG | Y | | | J1-74 | ENG CLT TEMP | 410 YEL | Y | | |
| J1-35 | EXTENDED CLUTCH SW | SEE APP DWG | | N | | J1-75 | IGN B | 1820 PNK | Y | | |
| J1-36 | INJ A | 1744 BLK | Y | | | J1-76 | INJ F | 845 BLK/WHT | Y | | |
| J1-37 | INJ E | 846 YEL/BLK | Y | | | J1-77 | INJ B | 878 DK BLU/WHT | Y | | |
| J1-38 | CHNG OIL LP/LIFT DIVE | SEE APP DWG | | N | | J1-78 | PTO ENGAGE | TBD | | N | |
| J1-39 | START RELAY (LSD) | SEE APP DWG | | N | | J1-79 | 3/2 SHIFT/SKIP SHIFT | SEE APP DWG | | N | |
| J1-40 | PWR GRD B | 451 BLK/WHT | Y | | | J1-80 | VREF RTN E | SEE APP DWG | Y | | |

Figure : 3.1.5a - I PCM Pin Out /In Connector C1

ENGINE - BASE (GEN 1E L35 & M30/MT1)

PCM CONNECTOR CAVITY CHART

J2 [S] CONNECTOR

PCM CONNECTOR ASSY: 12191488
TPA (RED) 2 REQ'D: 12176410
COVER: 12191108

Pcm 32w99 Pin Map
99pcn32u_proto3 006

| CAVITY | FUNCTION | CIRCUIT/COLOR | USAGE Y | N | N. C. | CAVITY | FUNCTION | CIRCUIT/COLOR | USAGE Y | N | N. C. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| J2-01 | PWR GRD C | 451 BLK/WHT | Y | | | J2-41 | LEGR 1 LO | SEE APP DWG | Y | | |
| J2-02 | TCC CONTROL SOL | 418 BRN | Y | | | J2-42 | TCC ENAB/TR MD RELAY | SEE APP DWG | | N | |
| J2-03 | BHC COM/SEC F_PMP RLY | TBD | | N | | J2-43 | A/C CLUTCH RELAY | 459 DK GRN/WHT | Y | | |
| J2-04 | AIR SOL RELAY | 421 PPL | | N | | J2-44 | HI ID LP/REVLKOUT SOL | SEE APP DWG | | N | |
| J2-05 | DELIVERED TORQ | 454 TAN/BLK | | N | | J2-45 | FUEL TANK VENT | 1310 WHT | Y | | |
| J2-06 | FMTR 1 HI | 1228 RED/BLK | Y | | | J2-46 | MALF IND LAMP | 419 BRN/WHT | Y | | |
| J2-07 | LEGR 1 HI | 1676 RED | Y | | | J2-47 | SEE NOTES BELOW | SEE APP DWG | Y | | |
| J2-08 | FMTR 1 LO | 1229 LT BLU/WHT | Y | | | J2-48 | SHIFT A | 1222 LT GRN | Y | | |
| J2-09 | FUEL PUMP RELAY | 465 DK GRN/WHT | Y | | | J2-49 | SECONDARY PPM | SEE APP DWG | Y | | |
| J2-10 | TACH | 121 WHT | | N | | J2-50 | PRIMARY PPM | 817 DK GRN/WHT | Y | | |
| J2-11 | SEC A/C HI PRESS SW | 694 DK BLU | | N | | J2-51 | TRANS OIL TEMP | 1227 YEL/BLK | Y | | |
| J2-12 | LEGR 2 POS | TBD | | N | | J2-52 | ALT F TERM | 23 GRA | Y | | |
| J2-13 | CRUISE ENGAGED | SEE APP DWG | Y | | | J2-53 | TCS/SPK_RTD/MIL REQ | 1687 GRA/BLK | | N | |
| J2-14 | A/C PRESS SEN | 388 RED/BLK | | N | | J2-54 | FUEL LEVEL SEN | 1589 PPL | Y | | |
| J2-15 | ALT L TERM | SEE APP DWG | Y | | | J2-55 | A/C PRESS CYC SW | 693 DK GRN | Y | | |
| J2-16 | 4WD LOW GEAR SW | 1694 GRA/BLK | | N | | J2-56 | EHC DIAGNOSTIC | TBD | | N | |
| J2-17 | A/C REQUEST | 762 GRN DK/WHT | Y | | | J2-57 | VREF RTN C (IATREFLO) | SEE APP DWG | Y | | |
| J2-18 | A/C STATUS | 59 DK GRN | | N | | J2-58 | ENG OIL PRESS | SEE APP DWG | | N | |
| J2-19 | FRT AXLE SW | 1695 BLK/WHT | | N | | J2-59 | CRANK REQUEST | SEE APP DWG | | N | |
| J2-20 | TOSS LO | 822 LT GRN/BLK | Y | | | J2-60 | EST RTN ODD | 2129 BRN | | N | |
| J2-21 | TOSS HI | 821 PPL/WHT | Y | | | J2-61 | EST RTN EVEN | 2138 BRN/WHT | | N | |
| J2-22 | TISS HI | 1230 RED/BLK | Y | | | J2-62 | PRNDL C | 773 GRA | Y | | |
| J2-23 | TISS LO | 1231 DK BLU/WHT | Y | | | J2-63 | TRANS PSM A | 1224 PNK | Y | | |
| J2-24 | TPS | 417 DK BLU | Y | | | J2-64 | FUEL TANK PRESS | 890 GRN DK | Y | | |
| J2-25 | INDUCTION AIR TEMP | 472 TAN | Y | | | J2-65 | BHC VOLTAGE MONITOR | TBD | | N | |
| J2-26 | BST A | 2121 PPL | Y | | | J2-66 | BST B | 2128 PPL/WHT | | N | |
| J2-27 | EST C | SEE APP DWG | | N | | J2-67 | EST D | SEE APP DWG | | N | |
| J2-28 | EST E | 2126 LT BLU/WHT | | N | | J2-68 | EST F | 2125 DK GRN | | N | |
| J2-29 | EST G | SEE APP DWG | | N | | J2-69 | EST H | SEE APP DWG | | N | |
| J2-30 | VATS | 229 DK BLU | | N | | J2-70 | CAN SDATA HI | TBD | | N | |
| J2-31 | MAF | 492 YEL | Y | | | J2-71 | CAN SDATA LO | TBD | | N | |
| J2-32 | MAP | 432 LT GRN | Y | | | J2-72 | O2 HEATER LO/ FMTR 2 LO | TBD | | N | |
| J2-33 | FAN 2/CK GA LP/ACREC | SEE APP DWG | | N | | J2-73 | FUEL LEVEL SEN (SEC) | TBD | | N | |
| J2-34 | CANISTER PURGE | 428 DK GRN/WHT | Y | | | J2-74 | O2 HEATER HI/LEGR 2 HI | TBD | | N | |
| J2-35 | ALTERNATOR LAMP | 25 BRN | Y | | | J2-75 | O2 HEATER HI/ FMTR 2 HI | TBD | | N | |
| J2-36 | AIR PUMP RELAY | 436 BRN | | N | | J2-76 | IAC B HI | 1749 LT GRN/WHT | Y | | |
| J2-37 | SEE NOTES BELOW | SEE APP DWG | | N | | J2-77 | IAC B LO | 444 LT GRN/BLK | Y | | |
| J2-38 | FUEL/OIL PRESS GA | SEE APP DWG | Y | | | J2-78 | IAC A LO | 1748 LT BLU/BLK | Y | | |
| J2-39 | CAM SEN SUP | 631 RED | Y | | | J2-79 | IAC A HI | 1747 LT BLU/WHT | Y | | |
| J2-40 | PWR GRD D | 451 BLK/WHT | Y | | | J2-80 | O2 HEATER LO/LEGR 2 LO | TBD | | N | |

Figure : 3.1.5a -II PCM Pin Out /In Connector C2

The following table shows the different PCM ASM and Components coupled to the L35 engine per GM platforms.

| PCM ( 12 F ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Module ASM | 9368071 | 12201281 | 12201281<br>52370668 | 12201281 | 12201281 |
| Housing Extension | 15003789 | | | | |
| Bracket | 15005865<br>15714426 | 15047570 | 15766026 | 15047570 | 15767011 |
| Bolt/Screw/Nut | 3846202<br>11514139 | 11516568 | 11514519<br>11514006 | 11516568 | 11516568 |
| | | | | | |
| **Sensors ( 12 F )** | **P-Truck** | **C/K Truck** | **G-Van** | **M/L -Van** | **S/T Truck** |
| Oxygen Sensor | 25312191<br>25312201 | 25312191<br>25314006 | 25312191<br>25314006 | 25312191<br>25314006 | 25312191<br>25314006 |
| Mass Air Flow Sensor | 25168491 | Include in Air SubSystem | Include in Air SubSystem | Include in Air SubSystem | Include in Air SubSystem |

### 3.1.5b PCM Pin Out and Pin In – Marine and Industrial Applications

Marine Applications use a different control module : MEFI – 4 Multiport Electronic Fuel Injection. Interfaces as those described for vehicles application, OBD II, and Emissions requirement are not longer needed.

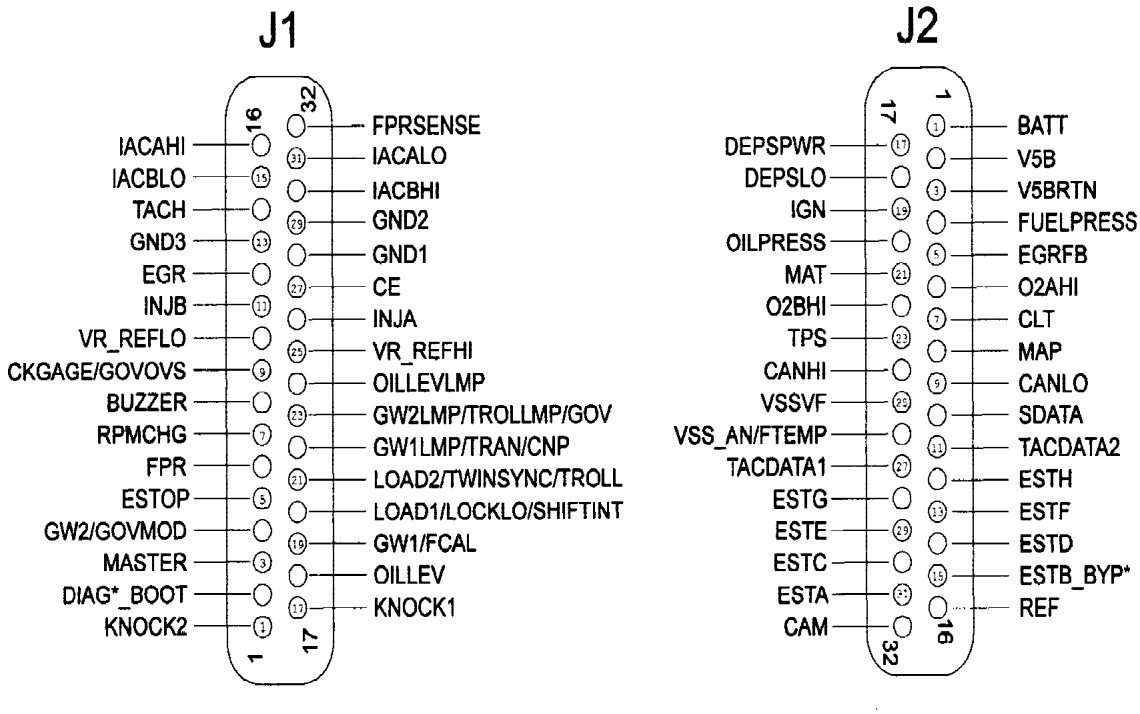
Table A.1 shows the connector pin out for MEFI Electronic Control Module (ECM) Part Number 12569494 Rev B.

**Table A.1 – Pinout**

| PIN | MEFI4 PIN NAME | PIN | MEFI4 PIN NAME |
|---|---|---|---|
| J1-1 | KNOCK2 | J2-1 | BATT |
| J1-2 | DIAG*_BOOT | J2-2 | V5B |
| J1-3 | MASTER | J2-3 | V5BRTN |
| J1-4 | GW2/GOVMOD | J2-4 | FUELPRESS |
| J1-5 | ESTOP | J2-5 | EGRFB |
| J1-6 | FPR | J2-6 | O2AHI |
| J1-7 | RPMCHG | J2-7 | CLT |
| J1-8 | BUZZER | J2-8 | MAP |
| J1-9 | CKGAGE/GOVOVS | J2-9 | CANLO |
| J1-10 | VR_REFLO | J2-10 | SDATA |
| J1-11 | INJB | J2-11 | TACDATA2 |
| J1-12 | EGR | J2-12 | ESTH |
| J1-13 | GND3 | J2-13 | ESTF |
| J1-14 | TACH | J2-14 | ESTD |
| J1-15 | IACBLO | J2-15 | ESTB_BYP* |
| J1-16 | IACAHI | J2-16 | REF |
| J1-17 | KNOCK1 | J2-17 | DEPSPWR |
| J1-18 | OILLEV | J2-18 | DEPSLO |
| J1-19 | GW1/FCAL | J2-19 | IGN |
| J1-20 | LOAD1/LOCKLO/SHIFTINT | J2-20 | OILPRESS |
| J1-21 | LOAD2/TWINSYNC/TROLL | J2-21 | MAT |
| J1-22 | GW1LMP/TRAN/CNP | J2-22 | O2BHI |
| J1-23 | GW2LMP/TROLLMP/GOV | J2-23 | TPS |
| J1-24 | OILLEVLMP | J2-24 | CANHI |
| J1-25 | VR_REFHI | J2-25 | VSSVF |
| J1-26 | INJA | J2-26 | VSS_AN/FTEMP |
| J1-27 | CE | J2-27 | TACDATA1 |
| J1-28 | GND1 | J2-28 | ESTG |
| J1-29 | GND2 | J2-29 | ESTE |
| J1-30 | IACBHI | J2-30 | ESTC |
| J1-31 | IACALO | J2-31 | ESTA |
| J1-32 | FPRSENSE | J2-32 | CAM |

# MEFI4 PROTO1 ECM Pinout

## CONNECTORS AS VIEWED EXTERNAL TO MODULE




h:~\MEFI4\pinouts\m4p1_po.cdr
03/19/99

### 3.1.6 Engine interface to exhaust

#### 3.1.6.1 Content

The engine is provided with exhaust manifolds for vehicles and Industrial Applications. The exhaust manifold system includes the manifold, fasteners to the cylinder head, and partial or full cover type heat shield. The exhaust manifold may also incorporate provisions for EGR attachment.

**Vehicle Exhaust System**

The 4.3L V6 90 Degree Engine shall be attached to the vehicle and interface with the Vehicle Exhaust System.
The Vehicle Exhaust System will be designed or adapted considering the following Issues:
Vehicle Exhaust System Back pressure: All performance parameters specified in paragraph: 2.3.2.1 were measured with a maximum exhaust restriction of 8.5" of Hg.

**Thermal Management of Exhaust**

Thermal management of exhaust

The following issues must be considered:

a. Location of Catalytic Converter: The location of the catalytic converter is determined by resolving three competing needs. The first need is to locate the converter such that it is close enough to the engine so that sufficient heat is transferred to the converter via the exhaust stream so as to initiate catalytic activity and therefore constituent conversion soon enough to meet emission requirements. The second need is to locate the catalytic converter far enough downstream from the engine in the vehicle's exhaust system so that the converter will not be damaged during extended duration high exhaust gas stream temperature excursions resulting from high speed and load operation of the engine. The third need is to locate the converter in a position in the chassis where it will package with sufficient clearance to surrounding components or systems to prevent heat related failures in those systems or components.

b. Location of Oxygen Sensor(s)

   All OBD II compliant exhaust systems contain enough oxygen sensors to guarantee proper monitoring of the exhaust gases. Each engine cylinder bank requires an oxygen sensor for air/fuel ratio control. An oxygen sensor is required behind each catalytic converter for diagnosis purposes. Post converter oxygen sensors are also implied for slow air/fuel ratio trim. Oxygen sensor wiring connections must be located to as to avoid moisture contamination.

c. Converter Volume and Flow

d. Location of muffler

e Vibration/shock of catalytic converter

f. Material life for exhaust system through catalytic converter

g. Thermal Characteristics

h. Exhaust Leakage

   The exhaust system must be leak free for the emission useful life of the vehicle.
   In order to have a working definition of leak free, the exhaust system is divided into three zones:

| | |
|---|---|
| Zone A (A/F Control) | Cylinder head / exhaust manifold interface to control oxygen sensor |
| Zone B (Converter Feedstream) | Control oxygen sensor to converter |
| Zone C (Diagnostic Feedstream) | Converter to 12 inches downstream of the diagnostic oxygen sensor |

Maximum allowable leakage in each zone is 2 liters/minute at 15 kPa.

The following table shows the different Exhaust Assemblies and Components coupled to the L35 engine per GM platforms.

| Exhaust ( 8 C ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Manifold ASM | 15986438 | 15029769 | 15029769 | 15029769 | 15029769 |
| Pipe ASM Exhaust | | 15045399<br>15034810<br>15743099 | | 15749444 | 15744824<br>15744826<br>15744828/9 |
| Manifold Seal | 12555091 | 15035747<br>15035748 | 11514597 | 12555091 | 12555091 |
| Manifold Gasket | 15997189 | 15997189<br>15767098 | 15997189 | 15997189 | 15997189 |
| Shield | | 15753676 | 15027911 | 15027911 | 15736668 |
| Screw/Bolt/Nut | 11514597<br>15733192 | 15733192<br>15032594 | 15997953 | 15023752<br>11514597 | 15023752<br>11514597 |
| | | | | | |
| Converter ASM | 25160620<br>15986441 | 15052911<br>15756278 | 15159709<br>15160977<br>15700838<br>15747730 | 15744810<br>15749445 | 15744810<br>15749445<br>12568312 |
| Converter Pipe ASM | 15986425<br>15986425<br>15986428 | 15709444 | 15709444 | N/A | N/A |
| Converter Gasket | 15027074 | 15027074 | 15027074 | 15027074 | 15027074 |
| Shield | 15739194<br>1507912 | TBD | 15739194<br>1507912 | 15027095<br>15150934 | TBD |
| Clamp | 15529483 | 15529483 | 15529483 | 15529483 | 15529483 |
| Screw/Bolt/Nut | 15709703<br>9442939 | 15709703<br>15997953<br>11517501 | 15709703<br>15997953<br>11517501 | 15709703<br>15997953<br>11517501 | 15709703<br>15997953<br>11517501 |
| | | | | | |
| Muffler ASM | 15727690 | 15040396<br>15040397<br>15061814 | 15008799<br>15159716<br>15761545 | 15756876<br>15756877 | 15756876<br>15756877 |
| Exhaust Pipe ASM | 15727691 | 15756780 | 15739879 | N/A | 15156883/4<br>15156936/5 |
| Shield | 15739195 | | 15739195 | 15990607 | 15990607 |
| Hanger/Bracket | 15986421<br>15986422 | 15986421<br>15986422 | 15986421<br>15986422 | 15152715 | 15023065/6<br>15976360<br>15976332 |
| Clamp | 15595047<br>15529483 | 15595047<br>15529483 | 15595047<br>15529483 | 15595047<br>15529483 | 15595047<br>15529483 |
| Screw/Bolt/Nut | 11515799<br>11515216<br>9424320 | 11515799<br>11515216<br>9424320 | 11515799<br>11515216<br>9424320 | 11500831<br>11515768<br>15695050 | 11500831<br>11515768 |

### 3.1.6.2 Back Pressure

Exhaust back pressure shall not exceed 8.5 inches of Hg at rated speed and load. Lower exhaust back pressure is desired from a performance and fuel economy standpoint.

### 3.1.6.3 Packaging

The vehicle assembly plant attaches the exhaust pipe to the manifold with the proper fasteners and a gasket or seal. Exhaust manifold takedowns will be 2 or 3 fastener designs.

Consult GM application engineer.

The current exhaust manifolds are made from Nodular Iron with incorporated and detachable heat shields.

Fasteners at the manifold takedown must be capable of withstanding temperatures up to 800°C and will require stainless steel or sermagard coated steel. The gasket/seal must also withstand these temperatures and will require stainless steel or stainless steel with mica or grafoil.

The heat shield provided on the exhaust manifold will reduce radiant heat to nearby critical components and reduce or minimize the number of separate shields required by the vehicle.

### 3.1.6.4 Exhaust Gas Recirculation (EGR)

| EGR ( 6 L 3 ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| EGR ASM Valve | 17200268 | 17200268 | 17200268 | 17200268 | 17200268 |
| | | | | | |

### 3.1.6.5 Secondary Air

GMPT will indicate the needs for secondary air recirculation.

The following table shows the different Secondary Air and EGR Assemblies and Components coupled to the L35 engine per GM platforms.

| Engine Secondary Air ( 6T ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Pump Air Inj ASM | | 15059238 | 15053709 | | 15056764 |
| Hose ASM | | 15022544 | N/A | | 15023825 |
| Hose ASM By Pass | | 15022570 | N/A | | 15760279 |
| Stud | | 20513798 | N/A | | |
| Washer | | | | | 15953691 |
| Strap | | | | | 11509086 |
| Bolt Screw | | | | | 11508706 |
| Pipe ASM | | 12561825 | 12562572 | | 12561250/51 |
| Check Valve (or Bypass) | | 12567731 | 12567745 | | 15037955 |
| Check Valve (or Bypass) | | 12567732 | 12567746 | | 15056713 |
| Bolt Screw | | 12558020 | 11515210 | | 15695050<br>9440034 |
| Gasket | | 12561871 | 12561871 | | 12561871 |
| Shield | | | | | 15026631 |
| Nut | | | | | 11514596 |

### 3.1.7 Engine Interface to Cruise Control

Figure 3.2.1-I to 3.2.1-XVIII shows the PCM Engine to Vehicle Mechanization Diagram with this interface. The following table shows the different Cruise Control Modules and Components used with the L35 engine and GM platforms.

| Cruise Control ( 6 N 4 ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Cruise Control Module | 25315559 | 25315559 | 25315090 | 25315087 | 15028014<br>15717608<br>25315088 |
| Cable | 15040802<br>15040801 | 15040802<br>15040801 | 15031096 | 15045430 | 15045460<br>15751730 |
| Bolt/Screw | 11517009<br>11518009 | 11517009<br>11518009 | 15685170<br>15983425<br>15685170 | 11515928 | 11508010<br>11517507<br>15685170 |

### 3.1.8 Accelerator Pedal

Figure 3.2.1-I to 3.2.1-XVIII shows the PCM Engine to Vehicle Mechanization Diagram with this interface. The following table shows the different Pedal Accelerator Assemblies and Components used with the L35 engine and GM platforms.

| Pedal Accelerator ( 6 N 2 ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Pedal Accelerator ASM | 15944514 | 15944514<br>15160381 | 15756441 | 15756441 | 15015757<br>15716466<br>15729139 |
| Cable | 15148661<br>15148662 | 15038820 | 15031093<br>15741073 | 15031093<br>15153422 | 15010419 |
| Bolt/ Screw | 9433298 | 11514516 | 11514516<br>11516150<br>11517519 | | 15010419 |

### 3.1.9 Engine to Evaporative Fuel System

Figure 3.2.1-I to 3.2.1-XVIII shows the PCM Engine to Vehicle Mechanization Diagram with this interface. The following table shows the different Fuel Lines, Fuel Tank and Evaporative Assemblies and Components coupled to the L35 engine per GM platforms.

| Fuel Evaporative ( 8 D ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Canister ASM | 17098106 | 15056485 | 17098085 | 17098085 | 17201171<br>17097127<br>17097120 |
| Shield | 15004076 | | | | |
| Hose | 10282447<br>15721451<br>15733597<br>15721447<br>15721448<br>15731510 | 15759042<br>15759043 | N/A | 15012787 | 9439150<br>15150414<br>15726983<br>15768562 |
| Clamp | 10108259<br>11516221 | 10108259<br>11516221 | N/A | 10108259<br>11516221 | 10108259<br>11516221 |
| Separator | 17096210 | N/A | 15032645<br>15032646 | 15032645<br>15032646 | 15032645<br>15032646 |
| Bracket | 15009801<br>15013689<br>15746404<br>17565062<br>15731699 | 15056490 | 15769694 | 15769694 | 15049107<br>15742240<br>15734230<br>15992101 |
| Harness | 12556909 | 12555973 | 12561900 | 12561900 | 11509087<br>12566190 |
| Strap | 11509087 | 11509087 | 15000499 | 11509087 | 11509087 |
| Valve | 12559015 | 15032643<br>15032644 | 15032643<br>15032644 | 15759225 | 25658328<br>12559015 |
| Bolt/Screw/Nut | 11508797<br>3847758<br>3975550<br>11515211 | 11516573<br>11513914 | 11515211<br>11508797<br>3847758<br>3975550 | 11515211<br>11508797 | 11515654<br>11515656<br>11515658 |

### 3.1.10 Accessory Drive System

The engine is released with an accessory drive system whose components are dimensioned and released as indicated in the paragraphs 3.1.11 to 3.1.16.

The maximum torque from the front crankshaft pulley is 150 ft lb., regardless of the engine speed; so it is recommended that the Belt System Drive maximum Torque requirement not to exceed 140 ft lb.

For torque values above 140 ft. lb. the customer shall provide different PTO assembly.

### 3.1.11 Standard Accessory Descriptions

GMPT accessory drive design release engineer will provide attachment points and drive of these components on the engine.

The following table 3.1.11-I shows the different combinations of components coupled to the L35 engine accessory drive brackets per GM platforms.

### 3.1.12 Cooling Fan

Cooling Fan assembly is not part of the engine scope or extent of supply.

Cooling fan is designed, dimensioned and released by the GM - HVAC engineering group taking in consideration the Heat Rejection (indicated in the paragraph 3.4.5) needed to evacuate from the engine through the radiator assembly.

If the Fan is driven from the crankshaft front pulley and the maximum torque values specified in paragraph 3.1.10 shall be taken in consideration.

### 3.1.13 Alternator

Alternator is not part of the engine scope or extent of supply.

Alternator is designed, dimensioned and released by the GM - Electrical engineering group taking in consideration all vehicles electrical power needs.

If the alternator is driven from the crankshaft front pulley and the maximum torque values specified in paragraph 3.1.10 shall be taken in consideration.

### 3.1.14 Power Steering Pump

Power Steering Pump is not part of the engine scope or extent of supply.

Power Steering Pump is designed, dimensioned and released by the GM - Chassis engineering group taking in consideration the vehicles drive needs.

If the power steering pump is driven from the crankshaft front pulley and the maximum torque values specified in paragraph 3.1.10 shall be taken in consideration.

### 3.1.15 AC Compressor

AC Compressor assembly is not part of the engine scope or extent of supply.

AC Compressor is designed, dimensioned and released by the GM - HVAC engineering group taking in consideration the Vehicle Air Conditioned needs.

AC Compressor is driven from the crankshaft front pulley and the maximum torque values specified in paragraph 3.1.10 shall be taken in consideration.

### 3.1.16 Crank Shaft Nose Load

Crankshaft maximum load at the nose will not exceed 140 Lbs.

The application engineer can provide information above accessory bracket assemblies available for various engine applications.

| | MY-2001 | MY-2001 | MY-2001 | MY-2001 | MY-2001 |
|---|---|---|---|---|---|
| **Steering Pump System ( 9E )** | **P-Truck** | **C/K Truck** | **G-Van** | **M/L -Van** | **S/T Truck** |
| **Steering Pump** | 26042592 | 15772602<br>26068923<br>26081015<br>15754215/16 | 26070078<br>26070099 | 26057292 | 26058060 |
| Steering Pump Pulley | 10085755 | 10085755 | 10085755 | 10085755 | 10085755 |
| Steering Pump Bracket RR | 10236998 | 10236998 | 10236998 | N/A | 10236998 |
| Steering Pump Reservoir | 15682455 | N/A | 26073040/1 | 26057780 | N/A |
| Steering Pump Cooler | 26063303/5 | 26063303/5 | 26063303/5 | N/A | N/A |
| Steering Pump Hose | 3931898 | 26051184 | 26040765 | 26057733 | 26057936 |
| Steering Pump Hose | 3773687 | 26068830 | 26063303 | 26063303 | 26042259 |
| Steering Pump Hose | 3786228 | N/A | N/A | 26055306 | 26055306 |
| Steering Pump Strap | 11501907 | N/A | N/A | 11509086 | 11509086 |
| Steering Pump Pipe | 15983287 | 26051176 | 26051176 | 26050743 | 15159570 |
| Steering Pump Clamp | 11516255 | 11516255 | 11516223 | 15735493 | 22514443 |
| Steering Pump Bracket Nut | 10242827 | 10242827 | 10242827 | 10242827 | 10242827 |
| Steering Pump Stud | 10224557 | 10224557 | 10224557 | 10224557 | 10224557 |
| Steering Pump Nut | 10242827 | 10242827 | 10242827 | 10242827 | 10242827 |
| Steering Pump Bolt | 11516349 | 11516349 | 11516349 | 11516349 | 11516349 |
| Steering Pump Bolt | 10244162 | 10244168 | 10244168 | 10244168 | 10244168 |
| Steering Pump Bolt | 11517950 | 11517950 | 11517950 | 11517950 | 11515586 |
| Steering Pump Bolt | 52476687 | 52476687 | 52476687 | 52476687 | 52476687 |
| **HVAC Compressor ASM ( 1A 2G )** | **P-Truck** | **C/K Truck** | **G-Van** | **M/L -Van** | **S/T Truck** |
| Compressor | 1136580 | 15766590 | 15766591 | 15765192 | 15765201/2 |
| Brace | N/A | N/A | N/A | 12555015 | N/A |
| Bolt Screw | 11516285 | 11516285 | 11516285 | 11516285 | 11516285 |
| Bolt Screw | N/A | 11516704 | N/A | 11516246 | N/A |
| Bolt Screw | N/A | N/A | N/A | 10157953 | N/A |
| Engineer | WE08 | XS03-U101 | 0AHD | U101 | 0UR1-U101 |
| Bracket HVAC ASM ( 9E ) | 12554522 | 12554522 | 12554522 | 12554522 | 12554522 |
| **Generator ASM ( 6Y1 )** | **P-Truck** | **C/K Truck** | **G-Van** | **M/L -Van** | **S/T Truck** |
| Alternator | 10480270/1 | 10480388/90 | 15768829/30 | 10480326 | 10480288 |
| Screw/Bolt Alternator | 11516704 | 11516704 | 11516285 | 11516285 | 11516285 |
| Screw/Bolt Alternator | 11516283 | 11516283 | 11516283 | 11516283 | 11516283 |
| Screw/Bolt Tensioner | 10244168 | 10244168 | 10244168 | 10244168 | 10244168 |
| Nut Tensioner | 10242827 | 10242827 | 10242827 | 10242827 | 10242827 |
| Stud Tensioner | 10224557 | 10224557 | 10224557 | 10224557 | 10224557 |
| Generator Bracket Rr | 10237271 | N/A | N/A | N/A | N/A |
| Screw/Bolt Bracket Rr | 11516284 | N/A | N/A | N/A | N/A |
| Bolt Screw | | | | | |
| Bolt Screw | | | | | |
| Engineer | WE08 | UT06 | OAKQ | UQ12 | UT06 |
| Bracket ASM | 10236997 | 10236997 | 10236997 | 10236997 | 10236997 |

Table 3.1.11-I Accessory Drive Brackets Components Combination

## 3.2 INTERFACES WITH VEHICLE SUBSYSTEMS

### 3.2.1a GMPT interface with Electrical Supply System-Truck Application

| Battery | Type | Description |
|---|---|---|
| | Model | 78A-72 |
| | Voltage | 12 |
| | Amps ( Minimum ) | 600 |
| | Minutes Reserve Capacity | 115 |
| | Amps/hrs.-20 hr. rate | 69 |
| Alternator | Type | Description |
| | Rating (idle/max. rpm) | 50 / 120 Amps |
| | Ratio (alt. crank/rev) | 2.52:1 |
| | Volt Nominal Output | 12 volts |
| Regulator | Type | Description |
| | Electronic | Integral to alternator |
| Electric Ignition | Type | Description |
| | High Energy Single Coil | Electronic Distributor |
| Spark Plug | Type | Description |
| | AC 41-931-Dual Pad Platinum | Gap 1.5mm |

See Table 3.1.11-I Accessory Drive Brackets Components Combination for Generator usage information.
The following table shows the different Harnesses and components used with the L35 engine per GM platforms.

| Electrical ( 12 H ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Harness ASM | 15323118<br>15301067<br>15301068<br>12153424<br>12153346<br>15301097<br>15311589<br>15323111<br>15323112 | 12172550<br>12172551<br>12172552<br>12172553 | 15059848<br>15059849<br>15059850<br>15059851<br>15059852<br>15059853<br>15059854<br>15059855<br>15059856<br>15059857<br>15059858 | 15045564<br>15045565<br>15045566<br>15062567<br>15062568<br>15062569<br>15062570<br>15763497 | 15328570<br>15328572<br>15328574<br>15328576<br>15328577<br>15328578<br>15365302<br>15365303<br>15365306<br>15365307<br>15770834 |
| Harness Extension | 15323114<br>15323164<br>15323165 | 15969147<br>15328807<br>15038561 | 15709061<br>15319959<br>15350451 | 15709061<br>15319959<br>15350451 | N/A |
| Bracket | 15985078<br>15002035<br>15708423<br>15023004<br>15985076<br>11501907<br>11509087<br>15517469<br>15990187 | 15033674 | 15738436 | 15993897<br>15733696 | 15999051<br>15741029 |
| Strap | 11501907<br>11509087<br>15517469 | 11501907<br>11509087<br>15517469 | 11501900 | 11501900 | 11509086 |
| Bolt/Screw/Nut | 3975550<br>566314<br>9440963<br>9440034<br>11509572 | 11516587<br>15714906<br>11516793<br>15709062<br>15735328 | 11516587<br>15714906<br>11516793<br>15709062<br>15735328 | 9419301<br>11516567<br>15994522<br>11503740<br>11515971 | 9440034<br>11500815<br>15961952<br>11506117<br>15961953 |

Figure 3.2.1-I to 3.2.1-XVI shows the PCM Engine to Vehicle Mechanization Diagram for the P-Truck platform application.

| Figure Number | Description |
|---|---|
| | Figure 3.2.1 - I Cooling, MAP, TPS and OIL Sensors |
| Figure 3.2.1a – II | EGR, Purge & Vent Solenoid Fuel Canister |
| Figure 3.2.1a - III | VSS (TISS & TOSS), Air Pump & Solenoid Relay |
| Figure 3.2.1a - IV | Engine to Transmission (Auto & Manual) |
| Figure 3.2.1a - V | Engine Injectors |
| Figure 3.2.1a - VI | TCC Switch & Cruise Control |
| Figure 3.2.1a - VII | Starter, Alternator & IP Gages |
| Figure 3.2.1a - VIII | Brake, ABS Switch, Serial Data Link I/P Cluster & Cruise Module |
| Figure 3.2.1a - IX | Oxygen Sensors |
| Figure 3.2.1a - X | Idle Air Controller & Knock Sensor |
| Figure 3.2.1a - XI | Fuel System and Optional ETC |
| Figure 3.2.1a - XII | Engine Ignition System |
| Figure 3.2.1a - XIII | Engine Crank & Cam Sensors |
| Figure 3.2.1a - XIV | HVAC |
| Figure 3.2.1a - XV | Power Distribution |
| Figure 3.2.1a - XVI | Note & references |

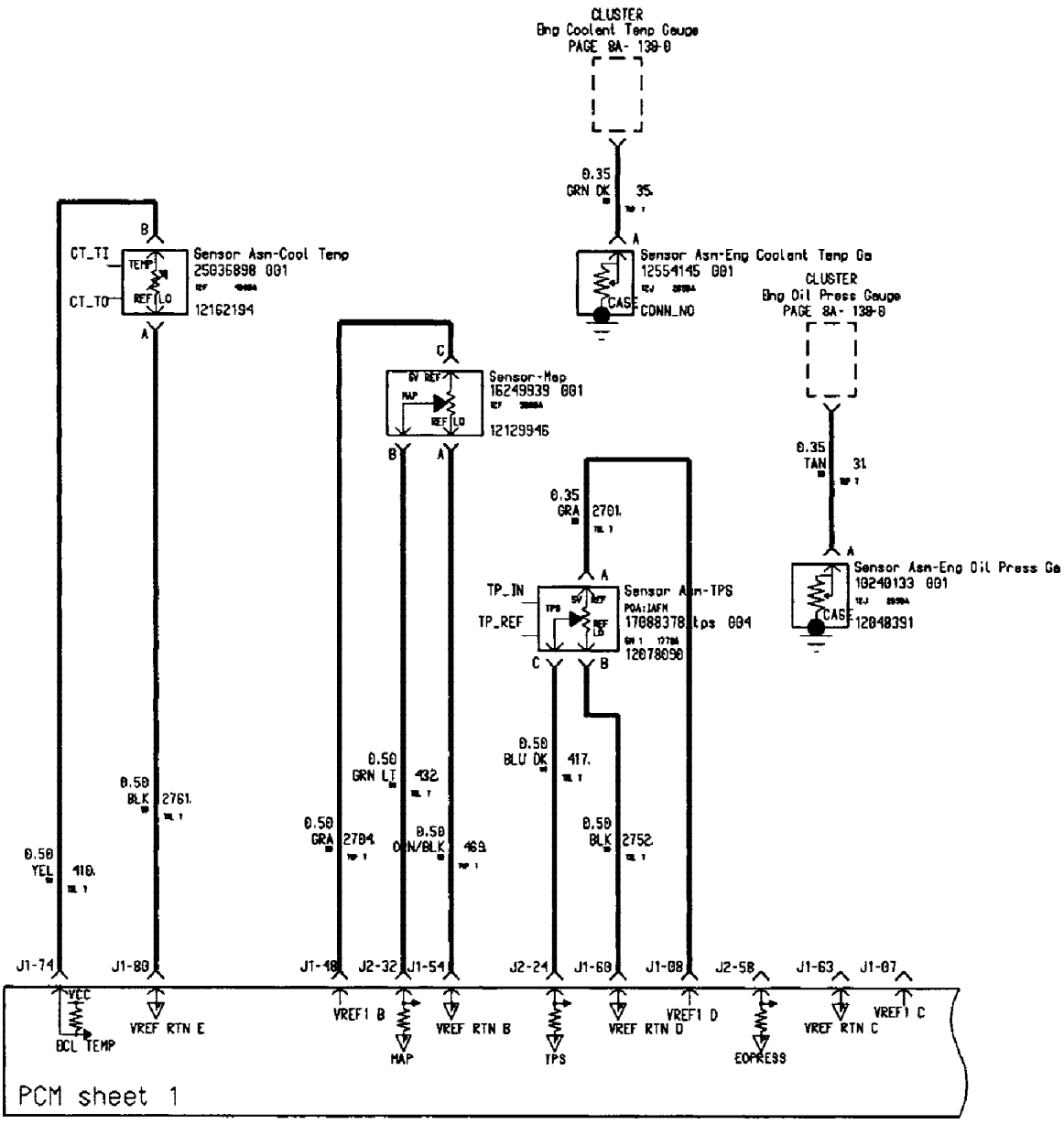



Figure 3.2.1a - I - P/Truck - Mechanization Diagram – Cooling, MAP, TPS and OIL Sensors

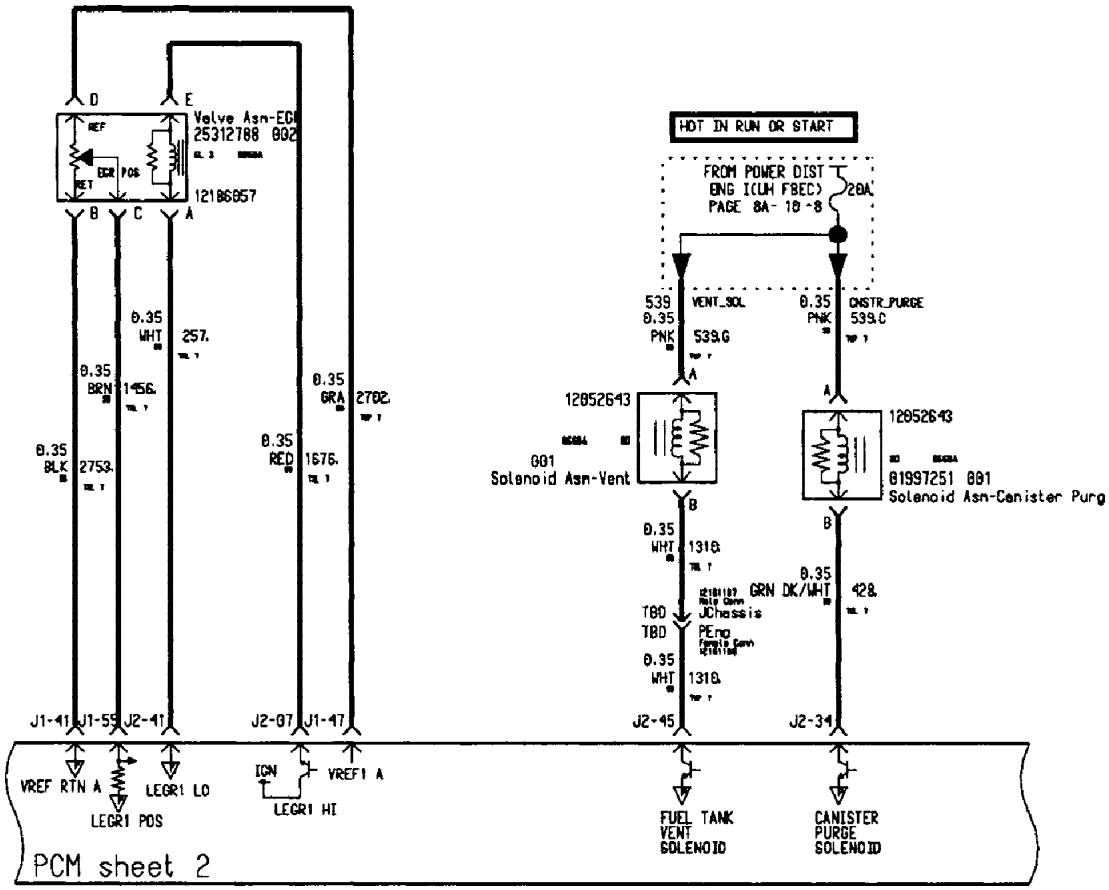



Figure 3.2.1a – II – P/Truck - Mechanization Diagram – EGR, Purge & Vent Solenoid Fuel Canister

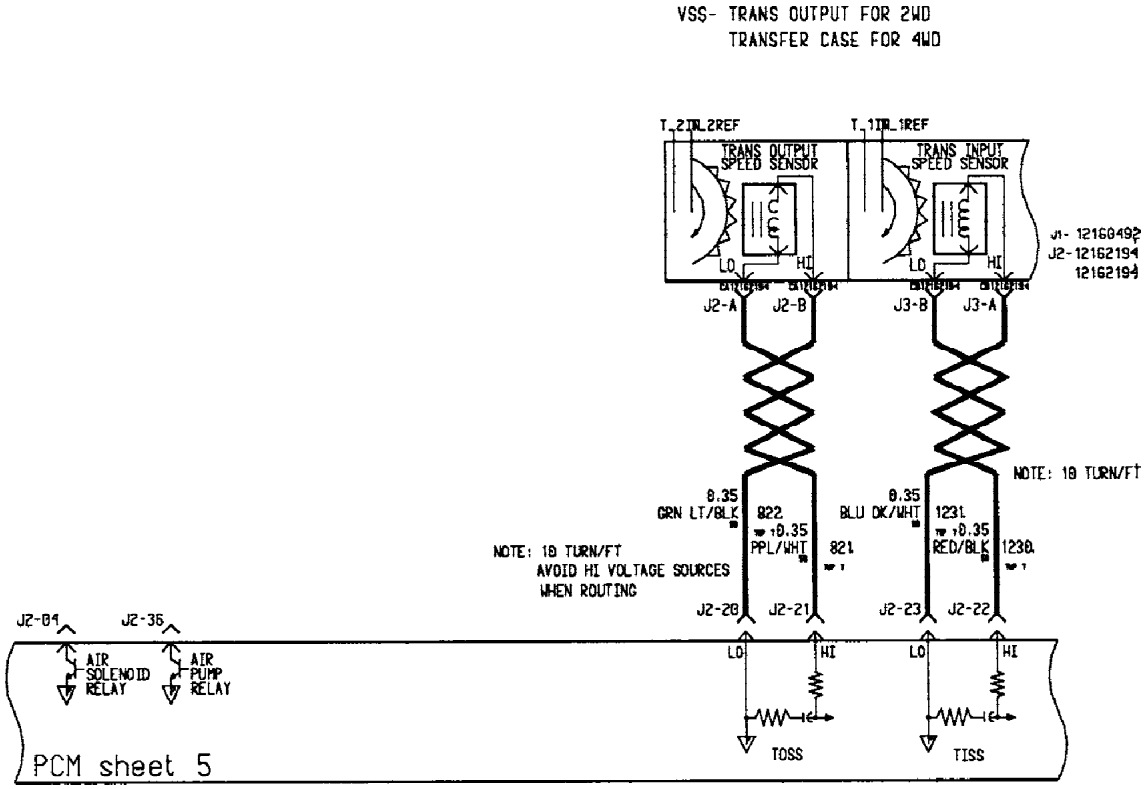



Figure 3.2.1a - III - P/Truck - Mechanization Diagram-VSS (TISS & TOSS), Air Pump & Solenoid Relay

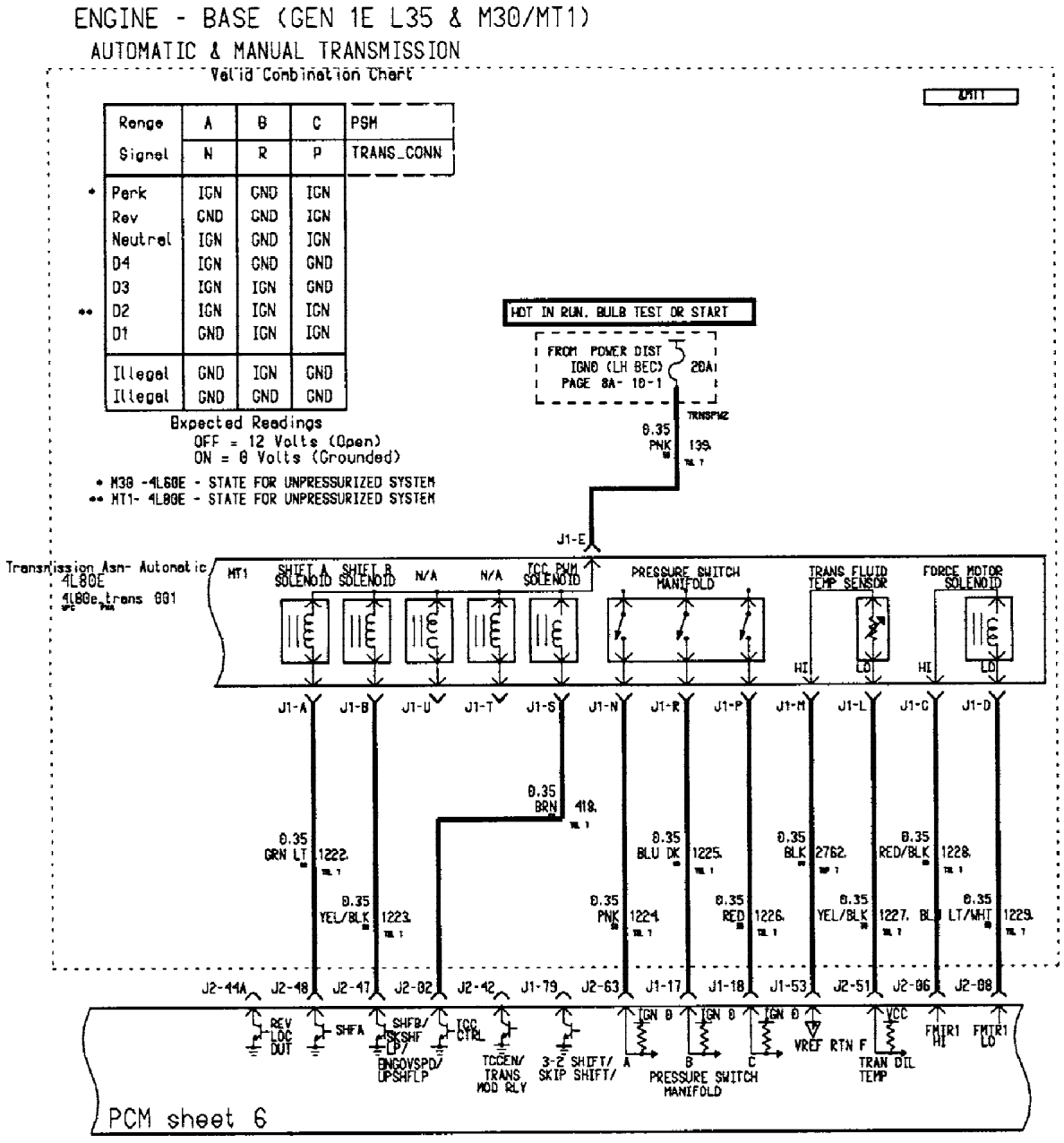



Figure 3.2.1a - IV - P/Truck - Mechanization Diagram – Engine to Transmission (Auto & Manual)

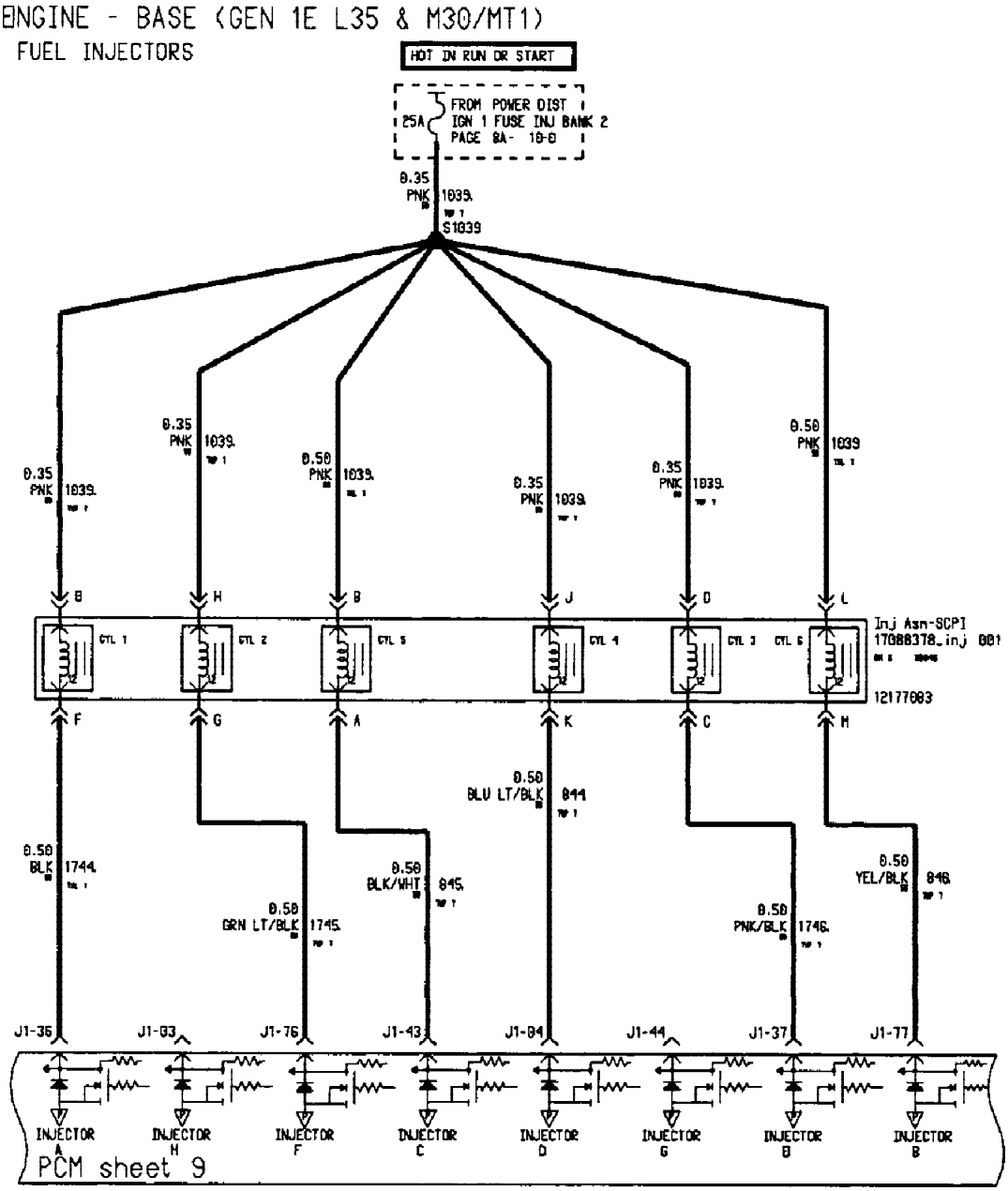



Figure 3.2.1a - V - P/Truck - Mechanization Diagram – Engine Injectors

ENGINE - BASE (GEN 1E L35 & M30/MT1)
PLATFORM CONNECTIONS

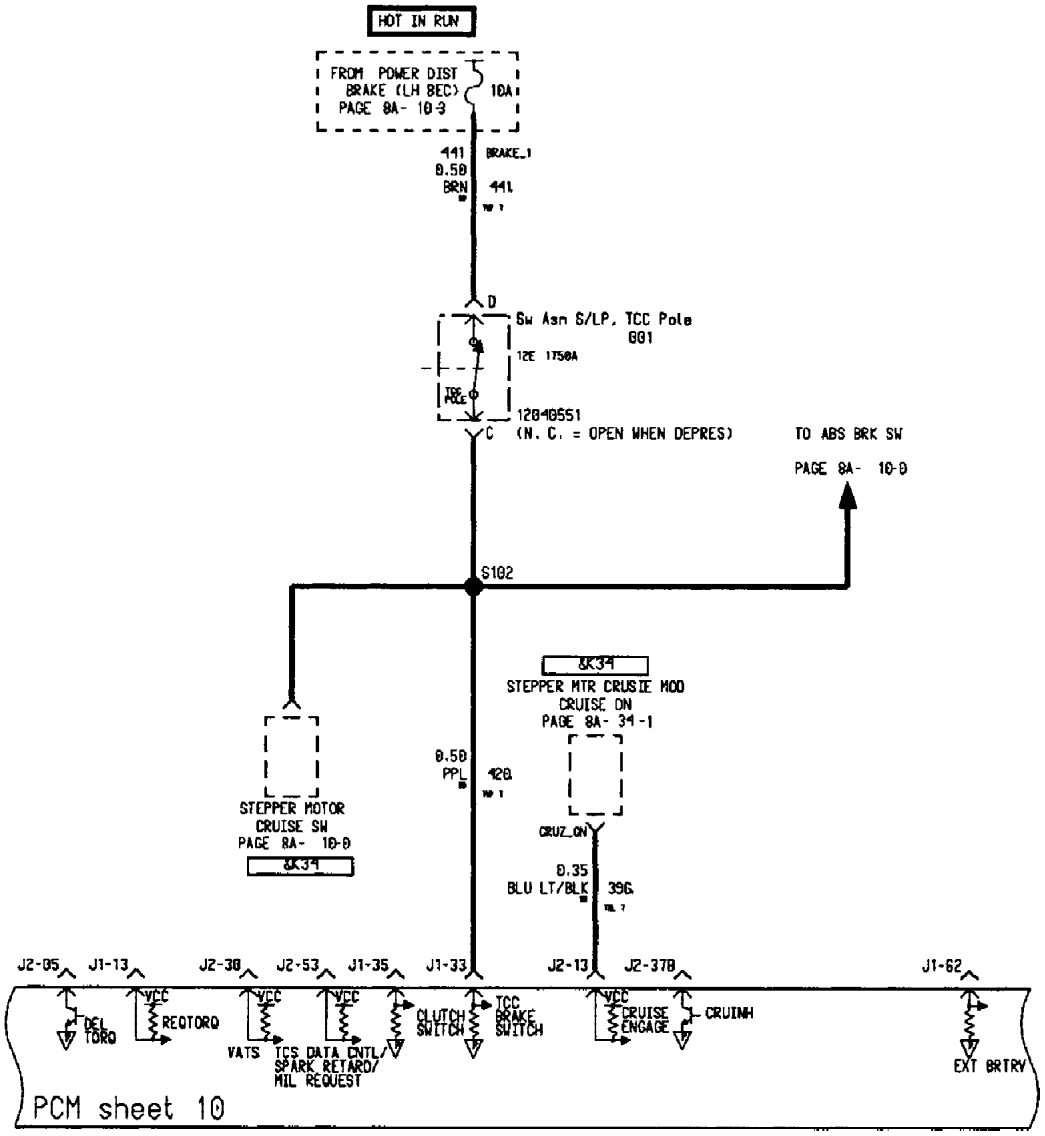



Figure 3.2.1a - VI - P/Truck - Mechanization Diagram – TCC Switch & Cruise Control

ENGINE - BASE (GEN 1E L35 & M30/MT1)
PLATFORM CONNECTIONS

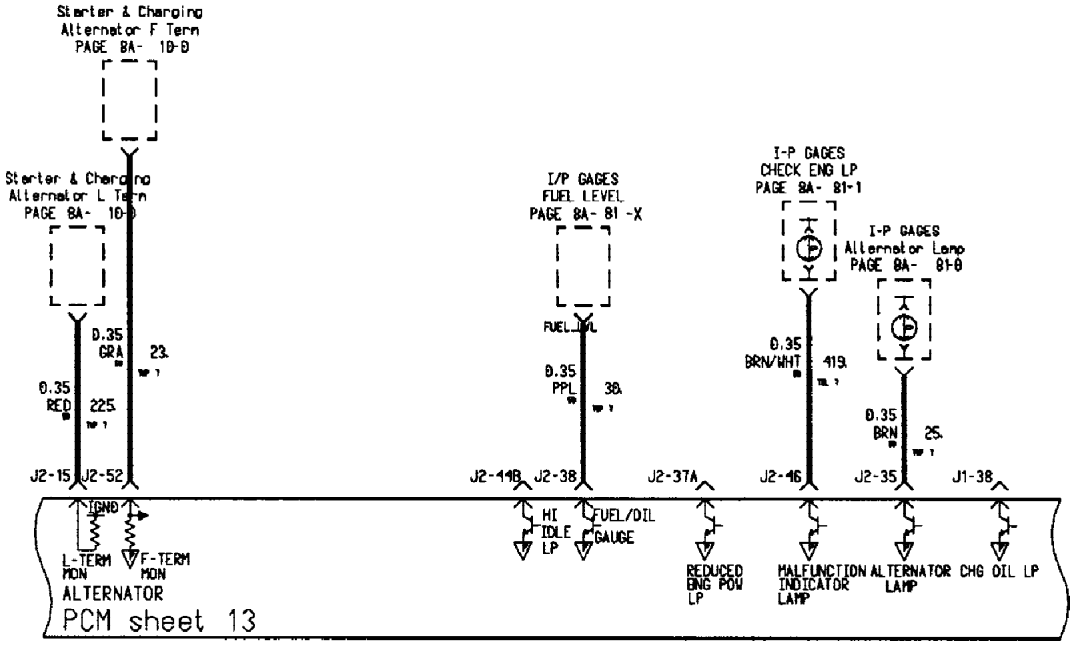



Figure 3.2.1a - VII - P/Truck - Mechanization Diagram – Starter, Alternator & IP Gages

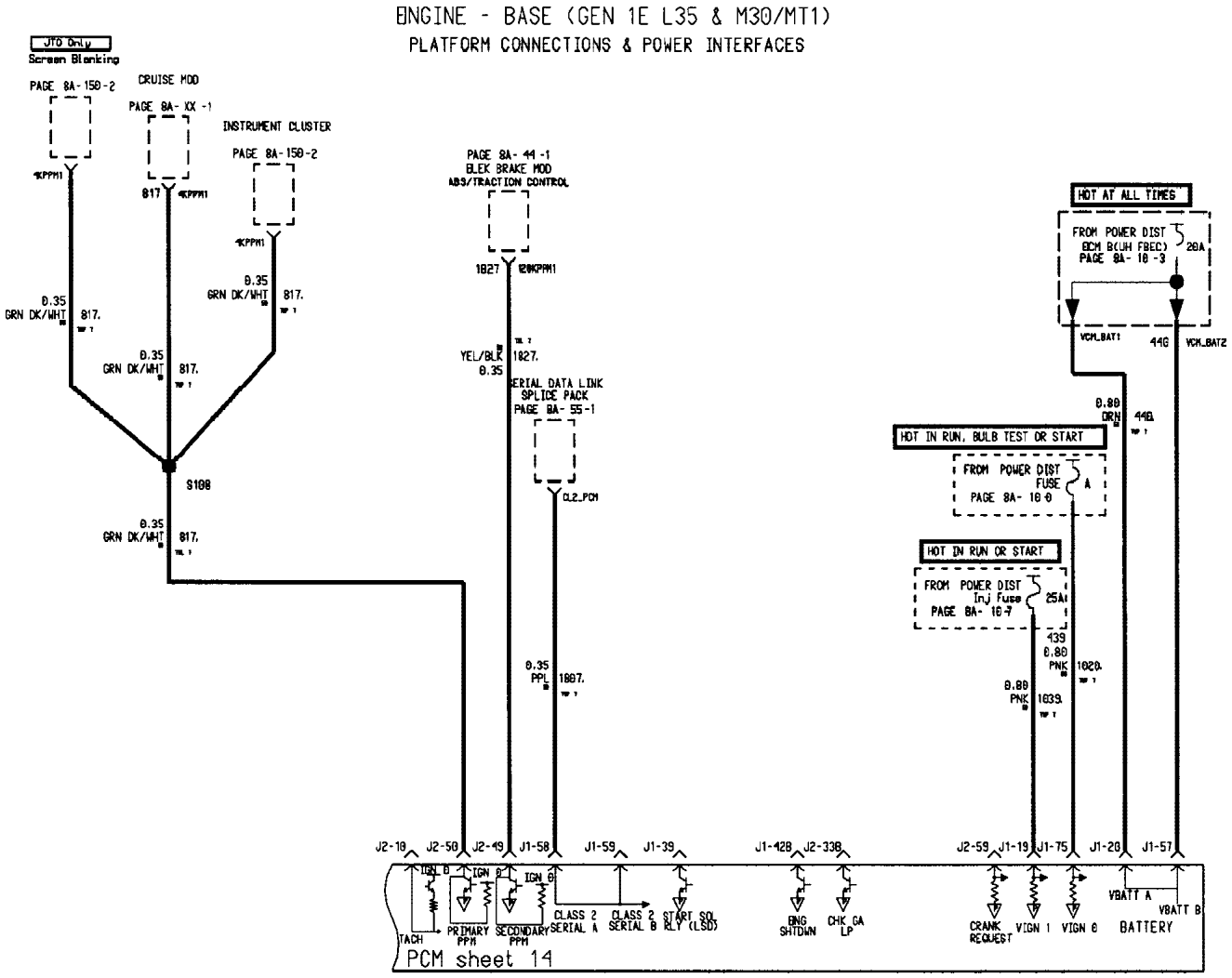
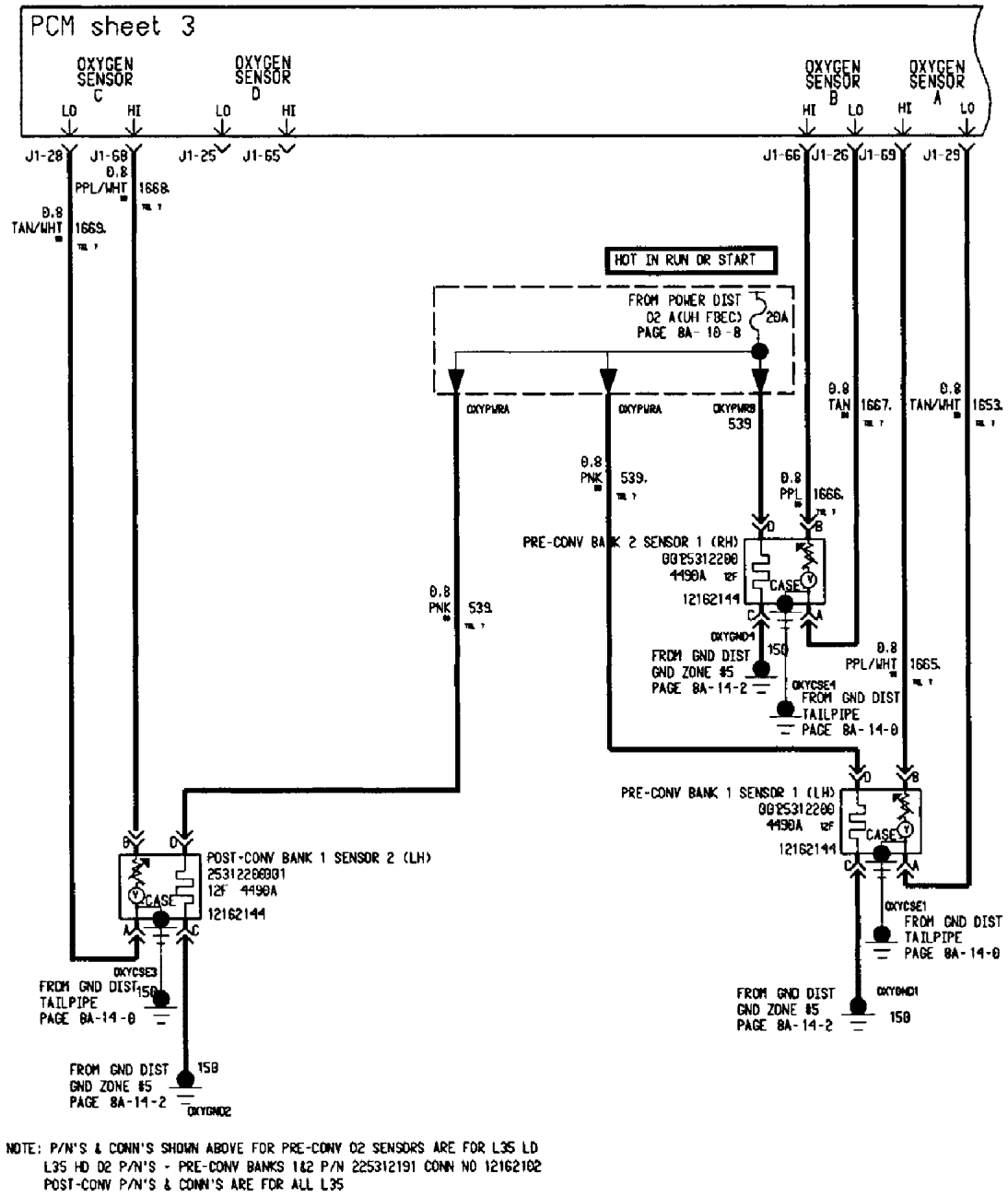



Figure 3.2.1a - VIII - P/Truck - Mechanization Diagram –
Brake, ABS Switch, Serial Data Link I/P Cluster & Cruise Module

ENGINE - BASE (GEN 1E L35 & M30/MT1)
ENGINE DATA SENSORS




NOTE: P/N'S & CONN'S SHOWN ABOVE FOR PRE-CONV O2 SENSORS ARE FOR L35 LD
L35 HD O2 P/N'S - PRE-CONV BANKS 1&2 P/N 225312191 CONN NO 12162102
POST-CONV P/N'S & CONN'S ARE FOR ALL L35

Figure 3.2.1a - IX - P/Truck - Mechanization Diagram – Oxygen Sensors

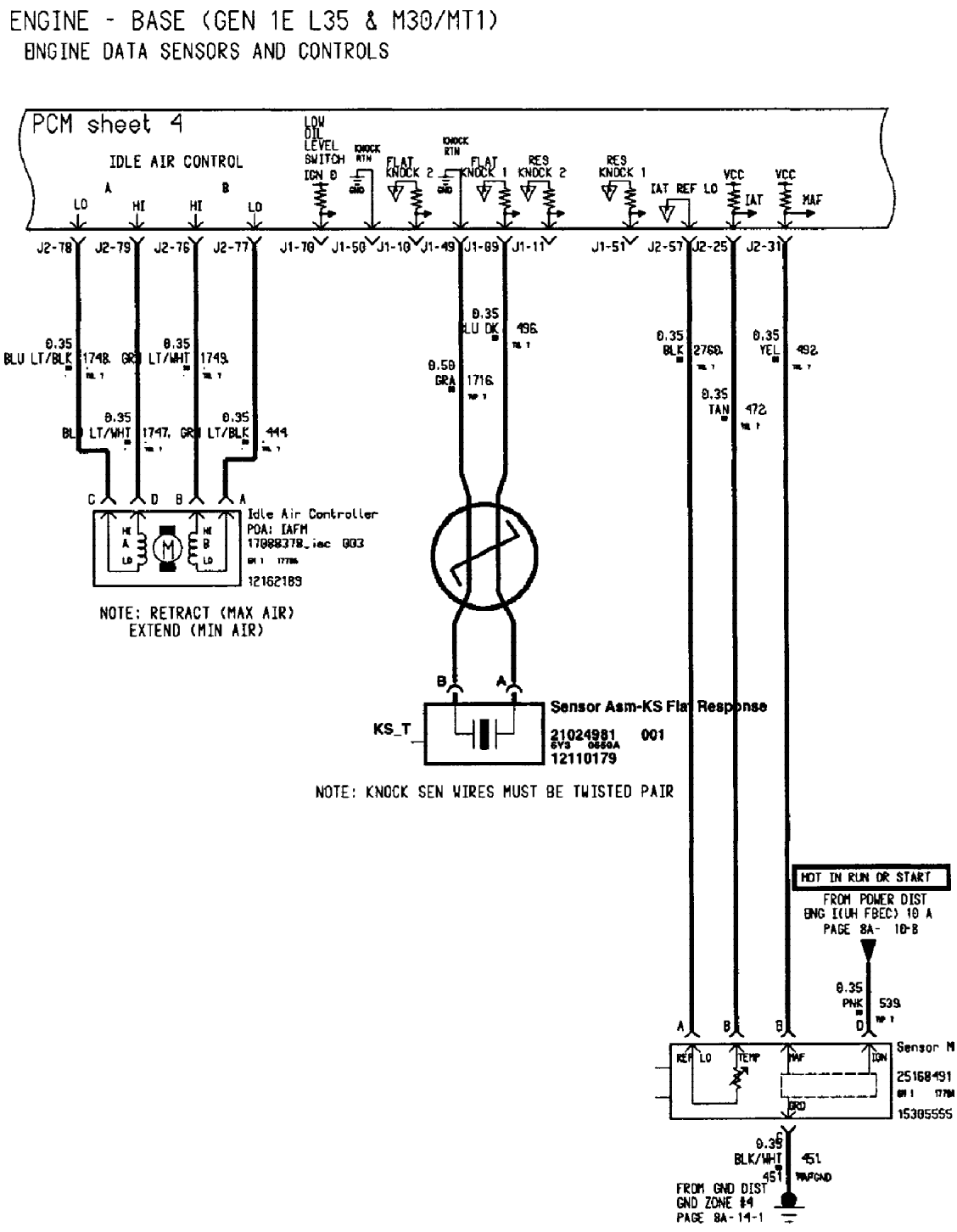



Figure 3.2.1a - X - P/Truck - Mechanization Diagram – Idle Air Controller & Knock Sensor

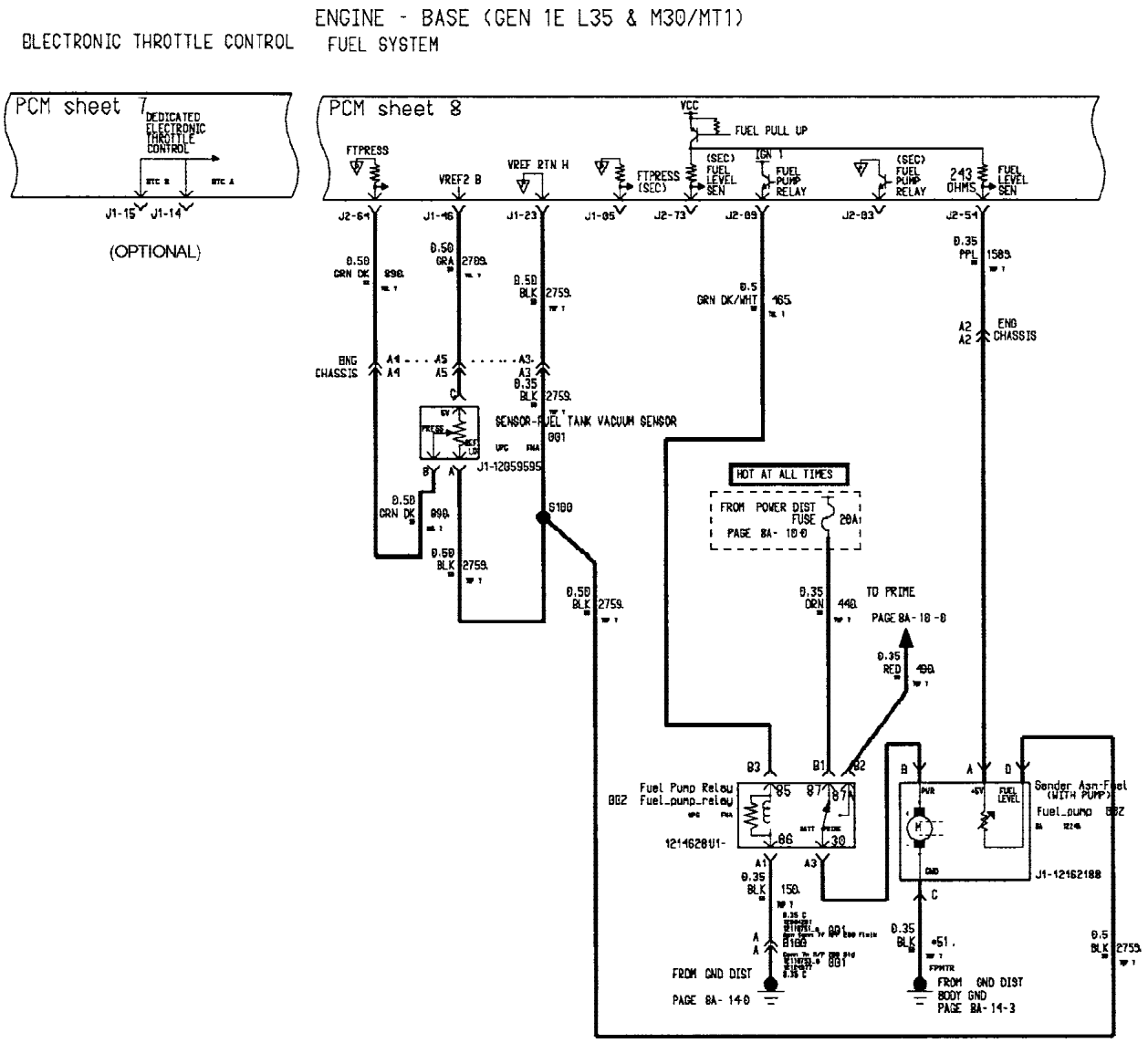



Figure 3.2.1a - XI - P/Truck - Mechanization Diagram – Fuel System and Optional ETC

ENGINE - BASE (GEN 1E L35 & M30/MT1)
IGNITION & DATA SENSORS

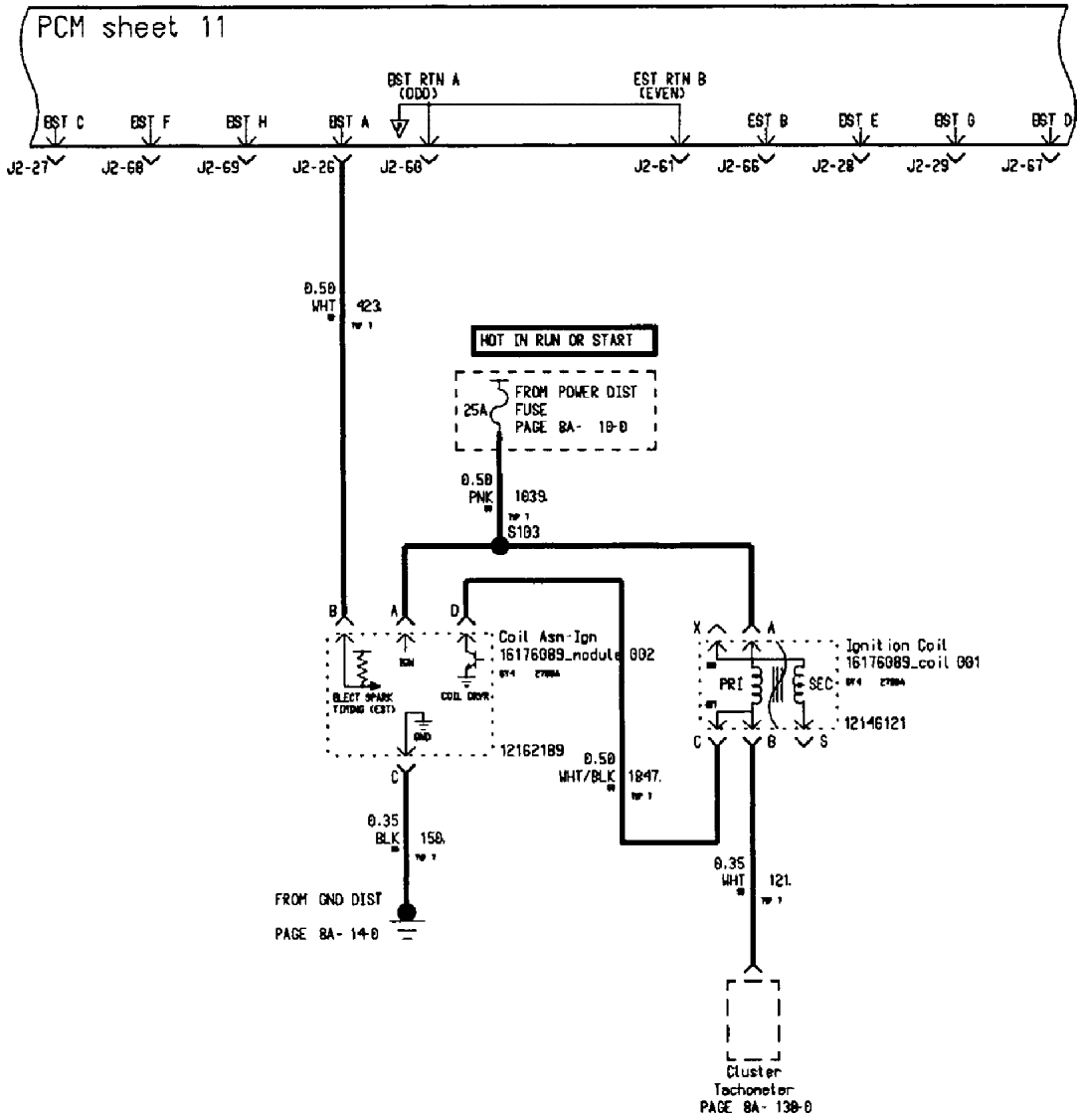



Figure 3.2.1a - XII - P/Truck - Mechanization Diagram – Engine Ignition System

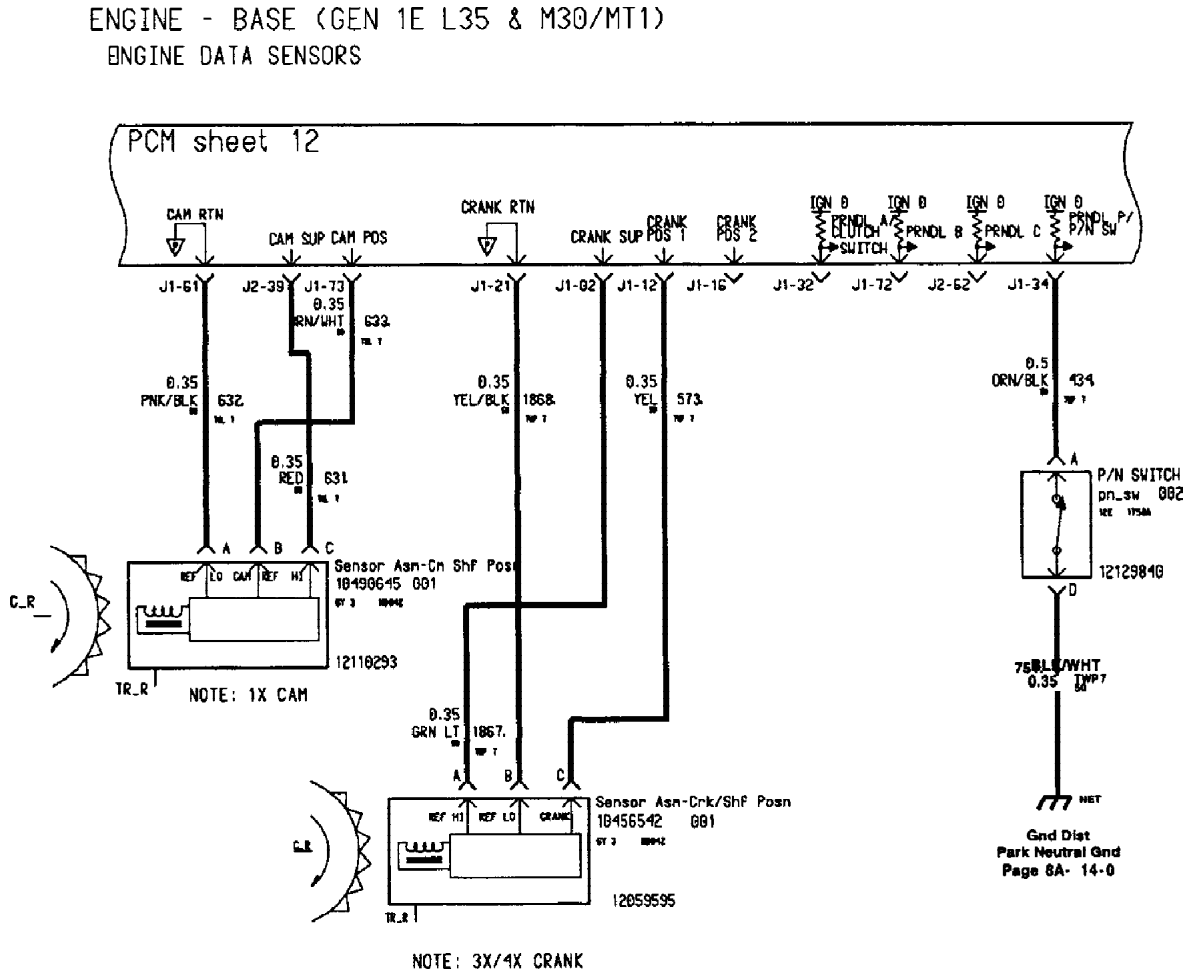



Figure 3.2.1a - XIII - P/Truck - Mechanization Diagram – Engine Crank & Cam Sensors

ENGINE - BASE (GEN 1E L35 & M30/MT1)
HVAC & COOLING FAN SYSTEM

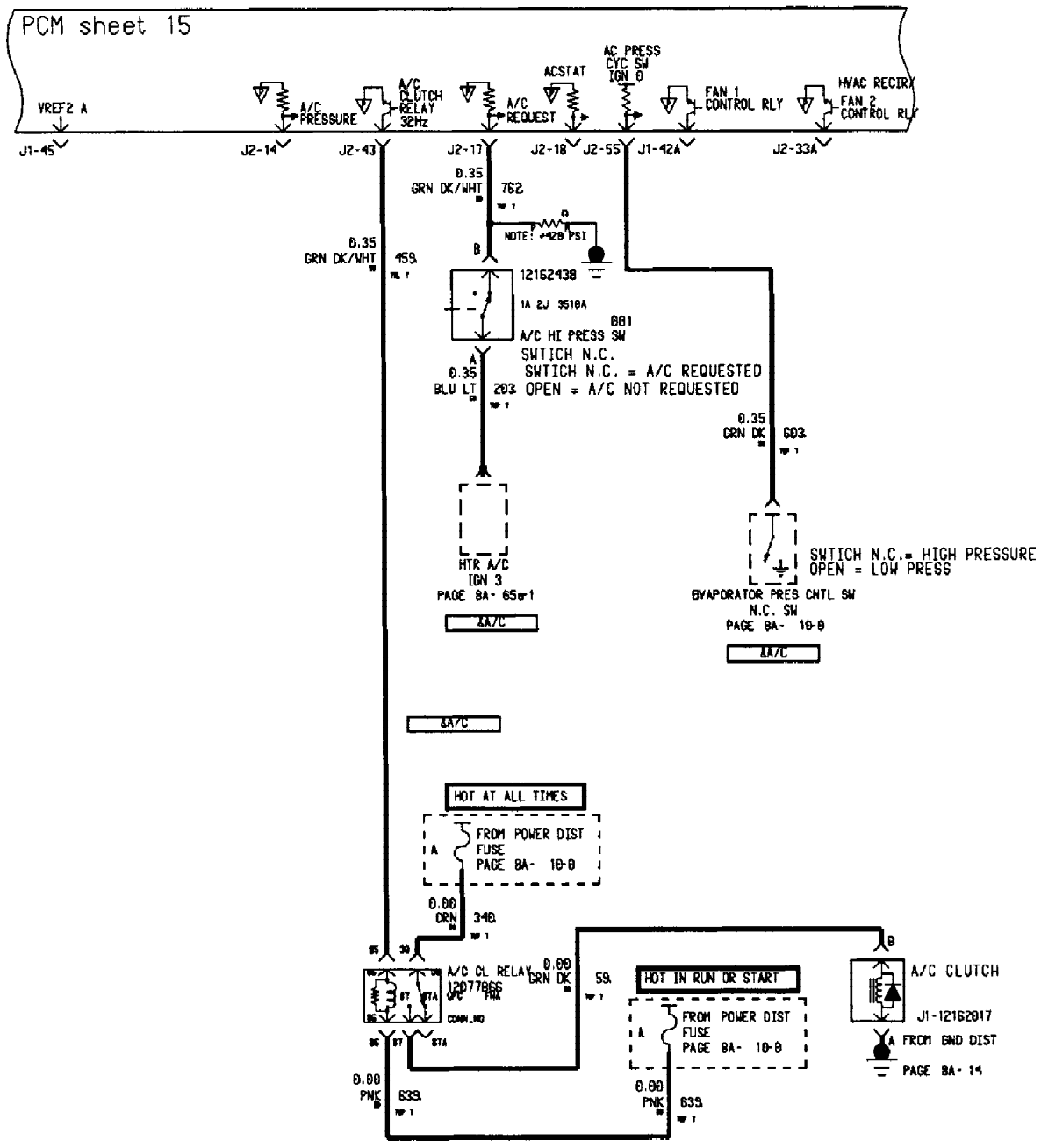



Figure 3.2.1a - XIV - P/Truck - Mechanization Diagram – HVAC

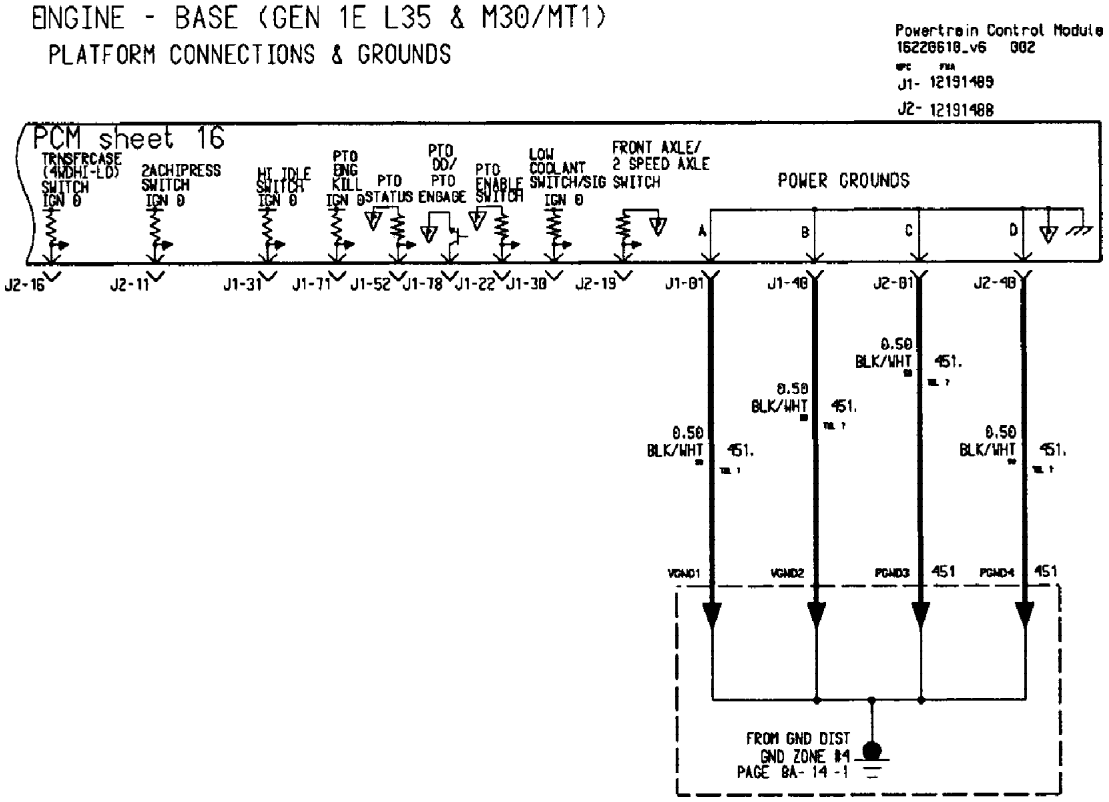



Figure 3.2.1a - XV - P/Truck - Mechanization Diagram – Power Distribution

ENGINE - BASE (GEN 1E L35 & M30/MT1)

SPECIAL NOTES:

NOTE # COMMENTS

1 OXYGEN SENSORS REQUIRE AIR REFERENCE, WHICH SHALL BE PROVIDED THROUGH THE WIRES CONNECTING THE OXYGEN SENSOR TO THE PCM.

2 PCM PIN NUMBERS WITH SUFFIX ALPHABET INDICATES SPLICE
J1-42A AND J1-42B
J2-33A AND J2-33B
J2-37A AND J2-37B
J2-44A AND J2-44B

3 BRAKE SWITCHES SPECIFIC PRIORITIES AND DEPENDENCIES

| DESCRIPTION | ORDER OF STATE CHANGE | ELECTRICAL CONTACTS |
|---|---|---|
| CC/TCC | 1 | N. C. |
| BLS | 2 | N. O. |
| BTS1 | 3 | N. C. |
| LOW OIL LVL | | N. C. |

4 LEGEND FOR "OBJECT ID"

OBJECT ID = 1gxx3530b1b1wt

- t=truck
- w = warren
- b1 = beta 1 (engine build level phase)
- b1 = beta 1 (vehicle build level phase)
- 30 = M30 (last 2 digits of the production intent transmission)
- 35 = L35 (last 2 digits of the production intent engine)
- gxx = G Van PlatForm (production intent platform)
- 1 = 2001 model year (last digit of production intent model year)

5. FIRING ORDER 1 - 8 - 7 - 2 - 6 - 5 - 4 - 3
BST DRIVERS A - B - C - D - E - F - G - H
(GEN III ONLY)

FIRING ORDER 1 - 6 - 5 - 4 - 3 - 2
BST DRIVERS A - B - C - D - E - F
(GEN 1E -V6 ONLY)

FIRING ORDER 1 - 8 - 4 - 3 - 6 - 5 - 7 - 2
A - B - C - D - E - F - G - H
(GEN 1E -V8 ONLY)

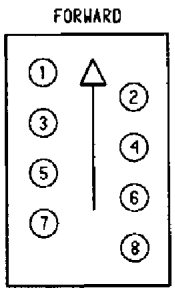



Figure 3.2.1a - XVI - P/Truck - Mechanization Diagram – Note & references

### 3.2.1b GMPT interface with Electrical Supply System- Marine and Industrial Application

Figure 3.2.1b-I to 3.2.1b-II shows the PCM Engine to Vehicle Mechanization Diagram for the Marine and Industrial Applications

| Figure Number | Description |
|---|---|
| Figure 3.2.1b - I | Cam, Crank, MAP,TPS and OIL Sensors |
| Figure 3.2.1b – II | Engine Injectors, Spark Plugs |

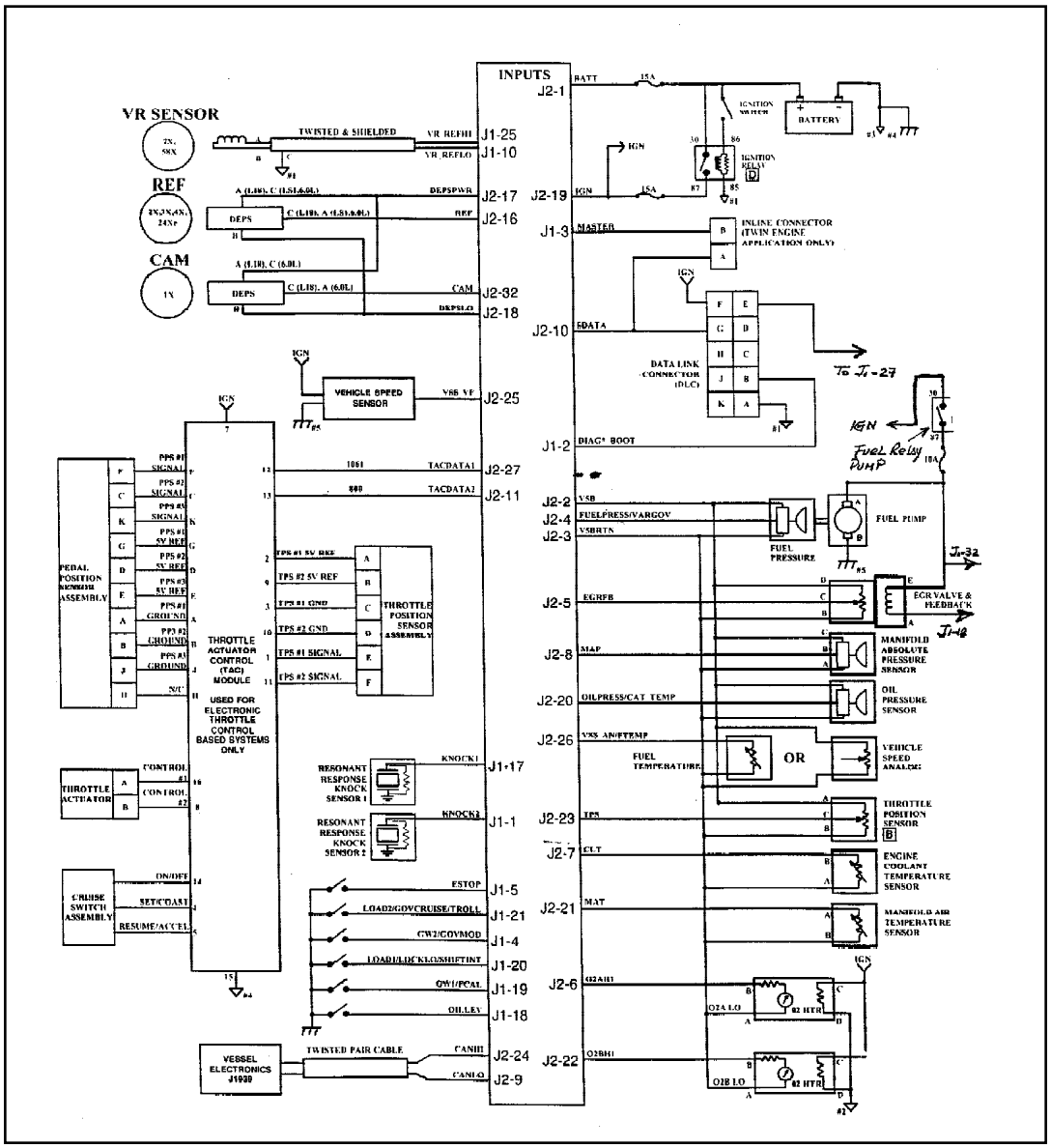



Figure 3.2.1b - I - Mechanization Diagram – Cam, Crank, MAP, TPS and OIL Sensors

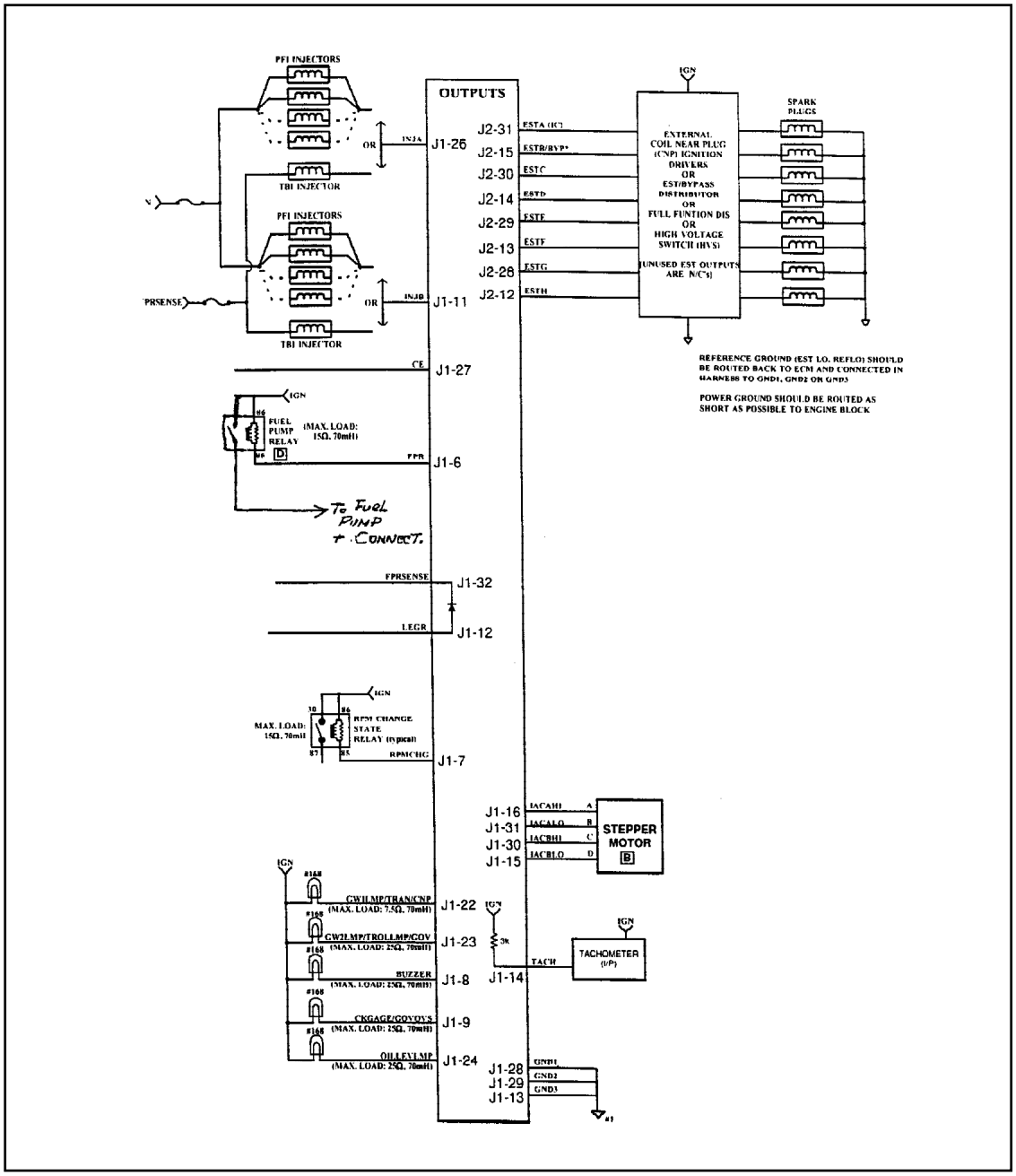



Figure 3.2.1b – II - Mechanization Diagram – Engine Injectors, Spark Plugs

### 3.2.2 GMPT interface with Electrical Starting System

| | | L35 |
|---|---|---|
| **Motor** | | |
| PG260 | Current Drain | 312 Amps |
| | Power Rating Kw | 1.4Kw |
| Motor Drive | Engagement Type | Solenoid Actuated Positive Engagement |
| Gear Reduction Type | Pinion Engages From: | Front |

The following table shows the different Starters and Components coupled to the L35 engine and GM platforms.

| Engine Starter ( 6 Y 2 ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Starter ASM | 12563829 | 12564107 | 12564107 | 12564107 | 12564107 |
| Shield | 12561327 | 12561327 | 12561327 | 12561327 | 12561327 |
| Bolt/Screw | 12561387<br>12555162<br>1246249 | 12561387<br>12555162<br>1246249 | 12561387<br>12555162<br>1246249 | 12561387<br>12555162<br>1246249 | 12561387<br>12555162<br>1246249 |

- Ignition voltage to PCM must be maintained at or above 7 volts during cranking.
- The operation of the 4.3L V6 90 Degree Engine System shall not adversely affect any of the vehicle electrical subsystems.
- Conversely, the operation of any vehicle electrical subsystem shall not adversely affect the operation of the 4.3L V6 90 Degree Engine System.
- Before performing any welding, disconnect negative battery cable and PCM connectors to avoid damage to other systems components.
- All engine electrical systems and controllers are not to exceed the allowable levels of radiated electromagnetic emissions described in specification GM 9114P dated December 14, 1994.
- Engine Electric Wiring Harness Including Connections Provisions For:
  Battery, Grounding Requirements, Mounting (Wiring Retention for Function and Appearance), Starter, Alternator, Sensors and Switches, Thermal Environment, IP Signal Information, Oil Life, Monitoring, Oil Level Sensing, PCM & Governor Wiring Assembly.
- All Electrical Connector Insertion Forces Less than 80 Newton's.
- The electrical generator assembly is not part of the engine scope of supply.

The following table shows the different Pre-Heaters and Components coupled to the L35 engine and GM platforms.

| Engine Pre Heather ( 6Y 2C ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Pre Heather ASM | 12556261 | 12556261 | 12556261 | 12556261 | 12556261 |
| Screw/Bolt | 15969147<br>11509126<br>11515763 | 15969147<br>11509126<br>11515763 | 15969147<br>11509126<br>11515763 | 15969147<br>11509126<br>11515763 | 15969147<br>11509126<br>11515763 |
| Cord ASM | 52353022<br>15726112 | 52353022<br>15726112 | 52353022<br>15726112 | 52353022<br>15726112 | 52353022<br>15726112 |
| Strap | 15517469 | 15517469 | 15517469 | 15517469 | 15517469 |

### 3.2.3 GMPT interface with CHASSIS BRAKE ABS System

Figure 3.2.1-I to 3.2.1-XVIII shows the PCM Engine to Vehicle Mechanization Diagram with this interface.

### 3.2.4 GMPT Interface with HVAC System

In order to properly attach the engine to the vehicle and interface with the Vehicle Cooling System the following cooling issues must be considered:

This engine is designed to operate with a surge tank that shall be located at the highest point of the cooling system.

a. Coolant contamination level
b. Corrosion protection
1. Coolant change intervals
2. Coolant type
c. Ports/Sealing
1. Water pump
e. By-pass System
1. Deaeration
2. Fill rate & capacity
3. System pressure and Draw Down
f. Engine Oil Cooler
d. Temperature Management
1. Thermostat and Low Coolant Sensor location

Figure 3.2.1-I to 3.2.1-XVIII shows the PCM Engine to Vehicle Mechanization Diagram with this interface.

#### 3.2.4.1 Fan Cooling System

Figure 3.2.1-I to 3.2.1-XVIII shows the PCM Engine to Vehicle Mechanization Diagram with this interface. The following table shows the different Fan ASM and Components coupled to the L35 engine per GM platforms.

| Engine Air Fan ASM ( 6K1 ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Tensioner | 12561094 | 12561094 | 12561094 | 12561094 | 12561094 |
| Bolt/Screw Tensioner | 11517648<br>11517649 | 11517648<br>N/A | N/A<br>11517649 | N/A<br>11517649 | N/A<br>11517649 |
| Belt | 12559620<br>12564759/60<br>12564763/4<br>N/A | 12569349<br>12569350<br>N/A<br>N/A | 12564749<br>12564760<br>12564761<br>12564763 | 12564762<br>12564759<br>N/A<br>N/A | 12564761<br>12564763<br>12564759<br>N/A |
| Blade ASM FAN | 15738321 | 15017911 | 15002575 | 15976889 | 15600390 |
| Blade ASM FAN | N/A | N/A | 15657381 | N/A | 15976889 |
| Bolt/Screw Blade | 15548719 | 11516869 | 15548719 | 15548719 | 15548719 |
| Clutch ASM FAN | 15735393<br>15735394<br>N/A | 22149836<br>22149880<br>15710101 | 22135998<br>22136704<br>N/A | 15976997<br>N/A<br>N/A | 15154901<br>22136712<br>N/A |
| Engine Pulley Crank Shaft | 10085754 | 10085754 | 10085754 | 10085754 | 10085754 |
| Bolt/Screw Pulley Crank Shaft | 10179287 | 10179287 | 10179287 | 10179287 | 10179287 |
| Pulley FAN | 12550053 | 12550053 | 12550053 | 12550053 | 12550053 |
| Bolt/Screw Pulley Fan | 11516292 | 11516292 | 11516292 | 11516292 | 11516292 |
| Pulley ASM Belt Idler | 12555609 | 12555609 | 10239930 | 10239930 | 10239930 |
| Pulley ASM Belt Idler | 12556612 | 12556612 | 12557819 | 12557819 | 12557819 |
| Pulley ASM Belt Idler | 12557819 | N/A | N/A | N/A | N/A |
| Bolt/Screw Fan Idler | 11515756<br>12550053 | 11515756<br>N/A | 11515756<br>N/A | 11515756<br>N/A | 11515756<br>N/A |

### 3.2.4.2 Coolant Properties

GMPT engines are liquid cooled and designed to operate with a mix of ethylene glycol and water. GMPT recommends a daily audit of glycol to water concentration and a yearly audit of water quality at the vehicle assembly fill station.

| | |
|---|---|
| **Mixture Ratio** | 52 % Ethylene Glycol and 48 % Water By Volume |
| **Ethylene Glycol Specifications** | Any Meeting GM 6277 M Specification |
| **Water Specifications** | Maximum Contaminants Or Range |
| - Total Solids | 350 PPM |
| - Total Hardness | 150 PPM |
| - pH | 6.9-9.0 |
| - Calcium And Magnesium | 100 PPM (COMBINED) |
| - Chlorides | 50 PPM |
| - Sulfates | 100 PPM |
| - Bicarbonates | 150 PPM |

### 3.2.4.3 Coolant Radiator (Recommended Minimum Values)

| **Cooling Radiator** | **L35** | **UNITS** |
|---|---|---|
| **Radiator Heat Evacuation To Coolant** | 4460 | BTU/Min |
| Total Average Heat Coefficient-<br>GM Recommend Better Than | 34 | BTU/Hr-sq. ft-F |
| **Radiator Efficiency -**<br>GM Recommend Better Than | 60% | |
| **Radiator Type** | Crossflow | |
| **Radiator Capacity (minimum)**<br>GM Recommend Better Than | 11.8 | Liters |
| **Minimum Radiator Frontal Area** | TBD by Customer | Sq. Meter |
| **Radiator Total Area** | TBD by Customer | Sq. Meter |
| **Radiator Coolant Flow<br>@ Rated Power** | | **GPM** |
| **Radiator Coolant Peak Pressure** | 103 | kPa |
| **Thermostat Open** | 170 | F |
| **Thermostat Fully Open** | 190 | F |
| **Radiator Coolant Inlet Location & Size** | Top/ 46.2 | mm |
| **Radiator Coolant Outlet Location & Size** | Bottom/ 60.0 | mm |
| **Fan** | Engine Driven<br>1:25 Ratio to Crank | |

#### 3.2.4.3.1 Heater Performance

Three coolant temperature performance exist in support of heater performance for the purpose of providing adequate cab heat. These temperatures shall be selected through the thermostat setting.

##### 3.2.4.3.1.1 Fast Warm-Up

The engine can provide a minimum of 170°F coolant to the heater in 10 minutes after the engine started to run from cold conditions.

##### 3.2.4.3.1.2 Uniform Comfort.

The engine can provide 190°F +/-5°F coolant to the heater at 20 minutes after the engine started to run from cold conditions.

##### 3.2.4.3.1.3 Degradation of Comfort

The engine can provide 190°F +/-5°F coolant to the heater during the 20 minutes idle, after the engine started to run from cold conditions.
A thermostat temperature of 190°F is assumed. A higher thermostat temperature is acceptable.

The following table shows the different Radiator ASM and Components coupled to the L35 engine per GM platforms.

| Engine Coolant Radiator ( 13A ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Radiator ASM | 52473151 | 52486600 | 15766916 | 52482175 | 52472963 |
| Radiator ASM | N/A | 52486601 | 15762434 | N/A | 52472964 |
| Radiator ASM | N/A | N/A | 15762437 | N/A | N/A |
| Radiator ASM | N/A | N/A | 15766914 | N/A | N/A |
| Cap Radiator | 15977333 | | 15982188 | 15982188 | 15982188 |
| Reservoir Coolant ASM | 15687277 | | 15030565<br>15058245 | 15720807<br>15720808 | |
| Bolt Screw or Retainer | 11509745 | | 11515904 | 22535007 | 15999164 |
| Bolt Screw or Retainer | N/A | N/A | N/A | N/A | 15685170 |
| Bracket ASM | 15996772 | | 15958651 | N/A | |
| Cap Reservoir | 14054390 | | | | |
| Hose Reservoir Coolant | 9439035 | | | | 15007480 |
| Hose Reservoir Coolant | 9439124 | | | | 15689607 |
| Hose Reservoir Coolant | 9439145 | | | | |
| Clamp | 3786276 | | 1622710 | 1622710 | 1626260 |
| Clamp | 14029188 | | | | |

### 3.2.4.3 Operating Conditions and Measures

#### 3.2.4.3.1 Heat Rejection

Heat rejection levels for combined engine coolant and oil are measured per GM Test #9 and are summarized in the table below. The values for the specific heat rejection to the coolant and Lube oil are shown below in table 3.5.3.1-I.

| RPM | L35 Truck Applications | L35 Marine Applications | Condition |
|---|---|---|---|
| | Heat rejection BTU/Min | Heat rejection BTU/Min | |
| 2000 | 1339 | n/a | Road Load |
| 2800 | 2038 | n/a | Road Load |
| 3600 | 2937 | n/a | Road Load |
| 1600 | 1536 | n/a | 7.2% Grade |
| 2400 | 2226 | n/a | 7.2% Grade |
| 2000 | 2209 | 2336 | WOT |
| 3000 | 3001 | 3202 | WOT |
| 4000 | 3910 | 4274 | WOT |
| 4200 | 4080 | 4314 | WOT |
| 4400 | 4309 | 4799 | WOT |
| 4600 | 4460 | 4716 | WOT |
| 750 | 486 | 539 | Idling |
| 1300 | 1016 | 1074 | Parked |
| 2200 | 1756 | 1826 | Parked |

Table 3.5.3.1-I 4.3L V6 90 Degree Engine Heat Rejection

#### 3.2.4.3.2 System Pressure

GMPT engines are designed to operate with a pressurized cooling system and surge tank. System pressure is controlled with a spring loaded pressure (RC33) relief cap with a nominal setting of 15 Psi.

#### 3.2.4.3.3 Coolant Operating Temperatures

This engine has been validated for continuous duty including continuous operation at WOT with the coolant temperature under thermostat control (see thermostat start to open and full open temperatures). Limited operation above thermostat full open temperature is allowed as shown in the table below.

| OPERATION | MAX ALLOWABLE TEMP |
|---|---|
| Extended Idle (Up To 30 Minutes) In Ambient up to >38 C | 262.4 F |
| City Traffic Operation In Ambient | |
| - Up To 109.4 F | 237.2 F |
| - Up To 118.4 F | 255.2 F |
| Grades | |
| - Trucks At GCW, 7.2% Grade, 100 F, Ambient | 250 F |
| - Passenger Cars At GVW, 7.2% Grade, 100 F , Ambient | 250 F |
| High Speed Operation | |
| - Passenger Cars At GVW, 167 kph, Up To 48 C Ambient | 237 F |
| Soaks Following Grade Operation | 262 F |

#### 3.2.4.3.4 Flow Rates

Flow to the radiator and heater vary with pump speed, thermostat valve position, and pressure drop across the heat exchangers.

| RPM | L35 All Applications | Condition |
|---|---|---|
| | Coolant Flow GPM | |
| 2000 | 32.5 | Road Load |
| 2800 | 46.1 | Road Load |
| 3600 | 59.9 | Road Load |
| 1600 | 26.1 | 7.2% Grade |
| 2400 | 37.7 | 7.2% Grade |
| 2000 | 32.6 | WOT |
| 3000 | 49.5 | WOT |
| 4000 | 66.6 | WOT |
| 4200 | 70.1 | WOT |
| 4400 | 73.6 | WOT |
| 4600 | 76.5 | WOT |
| 750 | 12.1 | Idling |
| 1300 | 21.2 | Parked |
| 2200 | 36.0 | Parked |

Figure: 3.2.4.3.4 - I - Water Pump Flow Rates

#### 3.2.4.3.5 Coolant Fill

Assembly Plant- GMPT requires the engine cooling system to be at least 95% filled (from a dry system no bleed valves) before the engine is started.
Service- GMPT requires a clear unobstructed view of the coolant deaeration tank be provided in an underhood location. The system should be designed to be capable of replacing 95% of the coolant drained during a service situation without starting the engine or opening any bleed valves.

##### 3.2.4.3.5.1 System Drain Down

The system is to be designed to displace all air in the engine, hoses, heater(s), and radiator into the deaeration tank while the engine is operating. After the engine, upper radiator hose, and radiator are charged with coolant the charge must be maintained at all times prior to low coolant light activation. The only air in the cooling system should be located in the deaeration tank.

Letting air enter the engine, upper radiator hose, or radiator can allow coolant in the system to drain down, which is unacceptable. Drain down can result in a false indication of the coolant level at the deaeration tank.

It also forces the system to run aerated coolant for a short time after every cold start while the engine, upper radiator hose, and radiator are recharged with coolant.

##### 3.2.4.3.5.2 Service Fill/Procedure

Capability to fill the system to 95% or more of capacity without running the engine. This ensures enough coolant is in the system to prevent engine damage if run for extended periods of time without checking the coolant level. Rear heater systems generally can not be filled without running the engine making it difficult to achieve a 90% static fill. However, rear heaters are difficult to drain as well and typically do not have to be refilled during service fill. If the rear heater is drained, a few minutes of running at moderate engine speeds is usually adequate to flush the air out of the heater and achieve a 90% fill.

##### 3.2.4.3.5.3 Fill Rate

The system should be able to achieve a 95% static fill at the 3 GPM rate.

This indicates adequate sizing of the deaeration tank fill line and proper venting of the system.

##### 3.2.4.3.5.4 Drawdown Capacity

The cooling system must be capable of losing approximately 10% or 2.4L (2.5 QTS.) of coolant without aeration occurring or loss of flow. Run at 3500 RPM with a blocked open thermostat.

This allows the engine to operate without damage when only a 95% fill is obtained.

##### 3.2.4.3.5.5 Deaeration Capability

The ability for the system to run un-aerated within 20 minutes after a service fill. Run with an operating thermostat and at 3500 RPM. The system needs to be able to purge air into the deaeration tank during closed and partially open thermostat conditions.

##### 3.2.4.3.5.6 Air Handling Capability

The ability to lose no more than 50% of the water pump flow with 0.2 CFM of air injected into the engine. The air is injected into an area after the water pump to simulate a combustion leak into the coolant. Coolant loss during the test should not exceed the Drawdown capacity. Test run at 3500 RPM with a blocked open thermostat.

##### 3.2.4.3.5.7 Low Coolant Light Calibration

The low coolant light is to be calibrated to activate prior to coolant aeration occurring. Normally the low coolant light should come on when the amount of coolant lost is less than or equal to the Drawdown capacity.

In some installation (see 3.5.3.5.1) the Low Coolant Light will have to come on prior to the Drawdown capacity to prevent drain down.

### 3.2.4.4 Coolant and Heater Subsystem Descriptions

#### 3.2.4.4.1 Coolant Inlet- Water Pump Inlet Restriction

Typical Diameter: **60** mm +/- 0.3 mm.

The suction at the water pump inlet should not exceed approximately 1.0" HG (-1.0" HG pressure) when run at 3500 RPM without a pressure cap. Exceeding this suction could cause the lower radiator hose to collapse if the system loses cap pressure.

#### 3.2.4.4.2 Coolant Outlet-

Typical Diameter: **46.2** mm +/- 0.3 mm.

#### 3.2.4.4.3 Heater Feed-

Typical Diameter: 15.9 mm +/- 0.3 mm or 19.05 mm +/- 0.3 mm

#### 3.2.4.4.4 Heater Return

Typical Diameter: 15.9 mm +/- 0.3 mm or 19.05 mm +/- 0.3 mm

#### 3.2.4.4.5 Coolant Hose Material

GMPT requires hose material meeting GM specification 6140m, 6250m, 6278m, or 6149m (hose material specifications vary by the severity of the environment they will be subjected to).

Reference radiator and heater hose dimensional specifications listed on drwg. # 12552514. Suggested lubricant for ease of hose assembly to inlet nipple is GM 9985406

#### 3.2.4.4.6 Hose Clamps

GMPT requires the use of constant tension clamps for all hose connections.

Reference dimensional information on hose clamp drwg. # 11516215 and equivalents.

#### 3.2.4.4.7 Thermostat

- start to open temperature- **170**°F
- full open temperature- **190**°F

### 3.3.1 GMPT Interface with CHASSIS Fuel System

Figure 3.2.1-I to 3.2.1-XVIII shows the PCM Engine to Vehicle Mechanization Diagram with this interface.

| RPM | L35 Truck Application | L35 Marine Application | Units |
|---|---|---|---|
| 800 | 17.16 | 17.7 | PPH |
| 1200 | 26.45 | 27.3 | PPH |
| 1600 | 35.12 | 37.9 | PPH |
| 2000 | 44.17 | 46.7 | PPH |
| 2400 | 54.79 | 56.1 | PPH |
| 2800 | 64.74 | 67.9 | PPH |
| 3200 | 75.30 | 76.3 | PPH |
| 3600 | 84.40 | 85.1 | PPH |
| 4000 | 94.33 | 94.9 | PPH |
| 4400 | 102.80 | 104.3 | PPH |
| 4800 | 105.4 | 112.2 | PPH |
| 5200 | 106.97 | 119.0 | PPH |

Figure: 3.3.1 - I 4.3L V6 90 Degree Engine - Fuel requirements vs. Engine Speed

The following table shows the different Fuel Lines, Fuel Tank and Evaporative Assemblies and Components coupled to the L35 engine per GM platforms.

| Fuel ( 8 A ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Pipe ASM Fuel | N/A | N/A | 15030585 | 15000300 | N/A |
| Pipe ASM Fuel Feed | N/A | N/A | 15043227<br>15043228 | 15023800<br>15023801<br>15023802 | 15023800<br>15023801<br>15023802 |
| Fitting Fuel Pipe | 15550219 | 15550219 | N/A | 15036790 | 15036790 |
| Hose | 15733594<br>15035085<br>15721387 | 15765804<br>15765806 | N/A | 15054322 | 15054322 |
| Fuel Filter | 15530354<br>25055129 | N/A | 25121800 | 25171788 | 25171788 |
| Bracket | N/A | 15013855 | 15009324 | N/A | N/A |
| Clip/Clamp | 343449<br>15973085<br>15677730 | 343449<br>15973085<br>15677730 | 343449<br>15973085<br>15677730 | 343449<br>15973085<br>15677730 | 343449<br>15973085<br>15677730 |
| Bolt/Screw/Nut/Stud | 11515211<br>11516076<br>11508279 | 11515211<br>11516076<br>11508279 | 11515211<br>11516076<br>11508279 | 15604106<br>15708937<br>3932368<br>9428638 | 15604106<br>15708937<br>3932368<br>9428638 |

| Fuel Tank ( 8 B ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Fuel Tank ASM with Pump | N/A | 15759638<br>15759639 | 15017931<br>15017932<br>15767150 | 15747872<br>15066407<br>15020046<br>15062877 | 15013150<br>15028431<br>15048831<br>15761468<br>15762977<br>15762978 |
| Fuel Tank ASM no Pump | 15721311 | N/A | N/A | N/A | N/A |
| Fuel Pump | 25315352<br>25314575 | N/A | N/A | 15062879 | N/A |
| Fuel Valve | 15978533 | N/A | N/A | N/A | N/A |
| Pipe Filler | 15030687 | 15747585 | | 15052676<br>15015206 | 15061623<br>15062980<br>15062981 |
| Strap | 15311568 | 15745095<br>15745096<br>15770877<br>15770878 | 15015617<br>15015618<br>15745014<br>15745015 | 15745065 | 15015589<br>15032208 |
| Cap | 22616285 | 15763225 | 15746557 | 22660002 | 22660002 |
| Bolt/Screw/Nut/Stud | 9428638<br>11518477 | 11516551<br>11516770 | 11516523<br>11518476<br>11517784 | 15604106<br>11508561 | 15604106<br>11508561 |
| **Fuel Evaporative ( 8 D )** | **P-Truck** | **C/K Truck** | **G-Van** | **M/L -Van** | **S/T Truck** |
| Canister ASM | 17098106 | 15056485 | 17098085 | 17098085 | 17201171<br>17097127<br>17097120 |
| Shield | 15004076 | | | | |
| Hose | 10282447<br>15721451<br>15733597<br>15721447<br>15721448<br>15731510 | 15759042<br>15759043 | N/A | 15012787 | 9439150<br>15150414<br>15726983<br>15768562 |
| Clamp | 10108259<br>11516221 | 10108259<br>11516221 | N/A | 10108259<br>11516221 | 10108259<br>11516221 |
| Separator | 17096210 | N/A | 15032645<br>15032646 | 15032645<br>15032646 | 15032645<br>5032646 |
| Bracket | 15009801<br>15013689<br>15746404<br>17565062<br>15731699 | 15056490 | 15769694 | 15769694 | 15049107<br>15742240<br>15734230<br>15992101 |
| Harness | 12556909 | 12555973 | 12561900 | 12561900 | 11509087<br>12566190 |
| Strap | 11509087 | 11509087 | 15000499 | 11509087 | 11509087 |
| Valve | 12559015 | 15032643<br>15032644 | 15032643<br>15032644 | 15759225 | 25658328<br>12559015 |
| Bolt/Screw/Nut | 11508797<br>3847758<br>3975550<br>11515211 | 11516573<br>11513914 | 11515211<br>11508797<br>3847758<br>3975550 | 11515211<br>11508797 | 11515654<br>11515656<br>11515658 |

### 3.3.2 GMPT interface with Air Induction System

#### 3.3.2.1 Air Requirement

| RPM | L35 Truck Application | L35 Marine Application | Units |
|---|---|---|---|
| 800 | 23.8 | 24.9 | gr/sec |
| 1200 | 37.8 | 39.3 | gr/sec |
| 1600 | 51.8 | 52.7 | gr/sec |
| 2000 | 65.8 | 67.4 | gr/sec |
| 2400 | 81.3 | 82.9 | gr/sec |
| 2800 | 97.7 | 99.0 | gr/sec |
| 3200 | 113.7 | 116.3 | gr/sec |
| 3600 | 128.8 | 130.5 | gr/sec |
| 4000 | 143.3 | 142.3 | gr/sec |
| 4400 | 154.7 | 154.0 | gr/sec |
| 4800 | 160.9 | 165.1 | gr/sec |
| 5200 | 163.7 | 175.0 | gr/sec |

Figure: 3.3.2.1-I 4.3L V6 90 Degree Engine Air Requirements

#### 3.3.2.2 Air Flow Path

The air flow path in the vehicle at the air inlet of the air induction system shall not be obstructed with vehicle components that will cause loss of pressure or flow disturbance.

All performance parameters specified in paragraph: 2.3.2.1 were measured with a maximum air restriction of 1” of Hg.

As reference in table 3.3.2.1 - I, development power and torque data is shown to illustrate the order of magnitude that may result as increasing the induction restriction.

Table 3.3.2.1 - I
4.3L V6
Development Peak Power and Torque Levels
Induction Restriction *

| Induction Restriction | Torque (Lb.-Ft) | Power (Hp) |
|---|---|---|
| 1” Hg. | 264 | 200 |
| 1.2” Hg. | 262 | 198 |
| 1.4” Hg. | 260 | 196 |
| 1.6” Hg. | 258 | 194 |

***** Exhaust backpressure held at 11” Hg.

**3.3.2.4 Temperature Rise**

The intake of air must avoid the suction of air coming from the hot spot areas of the inside of the engine bay such as proximity to exhaust manifold.
As referenced in table 3.3.2.4 - I, development power and torque data is shown to illustrate the order of magnitude that may result as increasing the induction temperature.

Table 3.3.2.4 - I
4.3L V6
Development Power Variation and
Induction Temperature Increase

| Inlet Air Temperature (Deg-F) | Power Loss (%) |
|---|---|
| 77 | 0 |
| 90 | 2.7 |
| 100 | 5.1 |
| 122 | 8.5 |
| 144 | 11.6 |
| 176 | 16 |
| 208 | 20.3 |

**3.3.2.4 Filtration Requirements**

GMPT requires an air filtration medium that is capable of removing 98.7% of the material contained in reference material SAE “Course Dust”.
The following table shows the different Air Cleaner ASM and Components coupled to the L35 engine per GM platforms.

| Engine Air Cleaner ( 6 M 3 ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Air Cleaner | 25147074 | 25322546<br>15766610 | 15754209 | 15747601 | 15747865<br>15747867 |
| Bracket | 15982176<br>15987694 | 15735434<br>15735435 | | | 25171130 |
| Adapter | 15997186 | | | | |
| Bolt/Screw/Nut/Stud | 3846202<br>11508300<br>11509542<br>14045263<br>15992647<br>15994910 | 11516484<br>11516589<br>11516587<br>15994910 | 11516727<br>11992647<br>11514596 | 15992646 | 15994910<br>11515933 |
| Duct | 15985845<br>15985846<br>15729512<br>15971184<br>15755160<br>15020026 | 15057511<br>25168087 | 15016578 | 25160175 | 25173868 |
| Clamp | 15986419<br>2465839<br>8868639 | 15986419<br>2465839<br>8868639 | | | |
| Elbow | 15003750<br>15994899 | 15003750<br>15994899 | | | |

### 3.3.3 GMPT Interface with Oil Cooling Subsystem

#### 3.3.3.1 Oil Cooler Requirements -

Heat Rejection to Oil - Consult GM Application Engineer.
The following table shows the different Oil Cooling, Filter Assemblies and Components coupled to the L35 engine per GM platforms.

| Oil Cooling ( 6 G 3 ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| Oil Cooler ASM | 15722841 | 15021207 | 15021207 | 15021207 | 15021207 |
| Oil Hose Cooler ASM | 15007061 | 15736423 | 15736423 | 15764375 | 15760333 |
| Bolt/Screw/Nut | 9419683<br>11514139<br>15679508 | 9419683<br>11514139<br>15679508 | 9419683<br>11514139<br>15679508 | 9419683<br>11514139<br>15679508 | 9419683<br>11514139<br>15679508 |
| Bracket | 15557752 | | | | |
| Bolt Screw w/Nut | 11508253 | 11508253<br>11516071 | 11508253<br>11516071 | 11508253 | 11508253 |
| Strap | 11501907 | 15607246 | 15607246 | 15607246 | 15607246 |
| Bracket | 15996659 | 15029984 | 15029984 | 15029984 | 15029984 |
| Bolt Screw | 11509759 | 11515210 | 11515210 | 11504357 | 11504357 |
| Connector | | | | 15719697 | 15719697 |
| **Oil Filter ( 6 G 5 )** | **P-Truck** | **C/K Truck** | **G-Van** | **M/L -Van** | **S/T Truck** |
| Filter | 25170846 | 25014831 | 25014831 | 25014831 | 12556880<br>15026051<br>15026052 |
| Adapter | 12558731<br>12562830 | 3952301<br>12562831 | 3952301<br>12562831 | 3952301<br>12562831 | 12556880<br>15760334 |
| Fitting | N/A | 3853870 | 3853870 | 3853870 | 15689615 |
| Gasket | 12551589<br>12552828 | 12551589<br>12552828 | 12551589<br>12552828 | 12551589<br>12552828 | 12551589<br>12552828 |
| Bolt/Screw | 10168445 | 3951644<br>9421634 | 3951644<br>9421634 | 3951644<br>9421634 | 11508253<br>11505347<br>15701734 |

### 3.3.4 GMPT Interface with Chassis Engine Mountings

#### 3.3.4.1 Engine Packaging Dimensions

The packaging dimensions for the 4.3L V6 90 Degree referenced from the center line of crankshaft and the rear face of block are shown in the Figure 3.3.4.1-I. Adequate engine roll, load, or thermal clearances (which ever is largest) should be added to these dimensions.

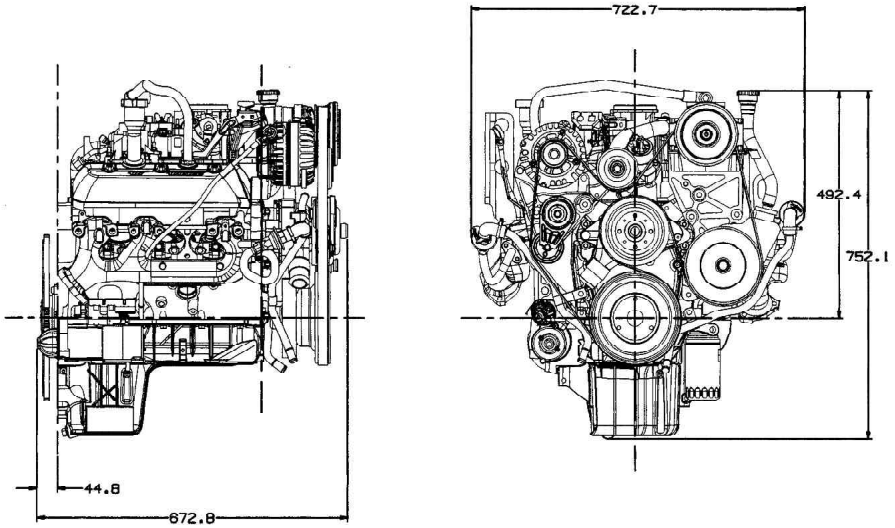



Figure 3.3.4.1 – L 4.3L V6 90 Degree Packaging Dimensions

#### 3.3.4.2 Recommended Installation Angles

See Figure 3.3.4.2 for the vehicle installation angle description in a transverse powertrain application.

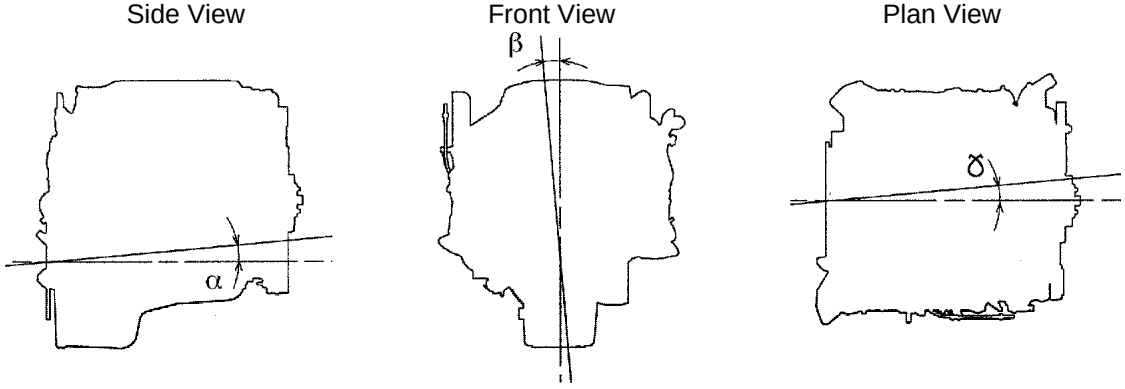



Figure 3.3.4.2 Installation Angles

**3.3.4.2.1 Recommended Side View Angle**
The a angle shown in powertrain side view shall not exceed **5** Degree. For greater values consult GM Application Engineering.

**3.3.4.2.2 Recommended Front View Angle**
The b angle shown in powertrain front view shall not exceed **5** Degree. For greater values consult GM Application Engineering.

**3.3.4.2.3 Recommended Plan View Angle**
The e angle shown in powertrain plan view shall not exceed **5** Degree. For greater values consult GM Application Engineering.

### 3.3.4.3 Rear Face of Block Configuration

The rear face of block is illustrated in Figure 3.3.4.3. Dimensions are from the center line of crank.

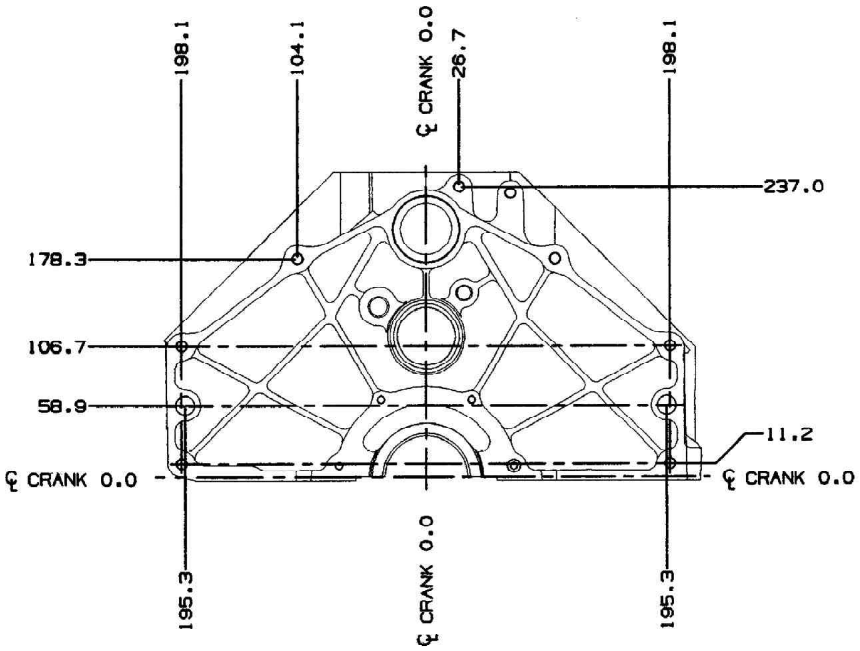



Figure 3.3.4.3 Rear Face of Block

### 3.3.4.4 Ground Clearance

No engine component shall be positioned below the vehicle dynamic ground line.

The following table 4.4.1-I shows the different Mounting Components coupled to the L35 engine per GM platforms.

| Powertrain Mounting ( 6 Q ) | P-Truck | C/K Truck | G-Van | M/L -Van | S/T Truck |
|---|---|---|---|---|---|
| **Engine Mountings** | | | | | |
| Engine Mounting ASM | 14031472 | 22174978 | 15017907 | 22112499 | 22173023 |
| Engine Mounting ASM | 15037192 | 22179440 | 15017908 | 22112500 | |
| Bolt Screw | 9420462<br>9424320<br>6262211 | 11516941-2-3<br>11517017-8 | 11515765<br>25623779 | 11509141<br>15596428 | 9442966<br>11517706 |
| Nut | 9442946<br>9442947<br>9418897 | 9442946<br>9442947<br>9418897 | 9442946<br>9442947<br>9418897 | 11516077<br>9442947<br>9418897 | 15956061<br>9442947<br>9418897 |
| Spacer | 15160007 | 15160007 | N/A | N/A | N/A |
| Bracket | 15041538<br>6259949 | 15753409<br>15753410 | 15969182<br>15054180 | 22145863<br>15697577 | 15725993<br>15725994 |
| Bracket | 15953632<br>6259950 | 15753411 | N/A | 15708672<br>15708673 | |
| Bracket | 15037193 | 15732463 | N/A | 15999045 | |
| Bracket | 15557731 | 15732464 | | 15999046 | |
| Bolt Screw | 9433115<br>9420462 | 9433115<br>9420462 | | 11509141<br>11509141 | 15672901 |
| Bolt Screw | 11517706 | 11517706 | | | |
| Washer | 407795<br>15531204 | 407795<br>15531204 | | | |
| Shield | 15037194 | N/A | 15764435-6 | | 15977043 |
| | | | | | |
| **Transmission Mountings** | | | | | |
| Trans Mounting ASM M74 | 15683966 | N/A | | | |
| Bolt Screw | 9441662<br>15592071 | | | | |
| Washer | 11505575 | | | | |
| Nut | 11516077<br>15151028<br>9442946 | | | | |
| Trans Mounting ASM MT1 | 17990857 | N/A | 22179376-7 | 22145766<br>15717594 | 15767866 |
| Bolt Screw | 15592071 | N/A | 11515946 | 11500831<br>11514071 | 15726468 |
| Washer | 11505575 | N/A | N/A | 11500046<br>11500223 | |
| Nut | 11516077 | N/A | 11514521 | 11515552 | 11515552 |
| Shields | N/A | N/A | 15160656 | | |
| Bolt Screw Shield | N/A | N/A | 15712486 | | |
| Trans Mounting ASM MG5 | N/A | 15761786 | N/A | | |
| Bolt Screw | N/A | 15592071 | N/A | | |
| Washer | N/A | 11505575 | N/A | | |
| Nut | N/A | 11516077 | N/A | | |
| | | | | | |
| Trans Mounting ASM M30 | N/A | 15768333 | N/A | | |
| Bolt Screw | N/A | 15592071 | N/A | | |
| Washer | N/A | 11505575 | N/A | | |
| Nut | N/A | 11516077 | N/A | | |

# 4.0 DETAILED PERFORMANCE DESCRIPTION

## 4.1 EXHAUST AND EVAPORATIVE EMISSIONS

### 4.1.1 EPA Certification

This engine when equipped with GMPT specified exhaust after treatment systems and GMPT transmissions has been certified to **EPA requirements**

### 4.1.2 CARB Certification

This engine when equipped with GMPT specified exhaust after treatment systems and GMPT transmissions has been certified to **CARB requirements**

### 4.1.3 Other Regulations

The Engine must comply with the following regulations: (Based on application and time of production.)

| GVWR # | LVW# | FEDERAL (TIER 1) (g/mile) | | | | | | CALIFORNIA (TIER 1) (g/mile) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6001 - 8500 | 3751 - 5750 | NOx | THC | NMHC | CO | PM | MILES | NOx | THC | NMHC | CO | PM | MILES |
| | | — | — | .32 | 4.4 | — | 50K | .98 | | .45 | 6.4 | .10 | 120K |
| | | .98 | .80 | .46 | 6.4 | .10 | 120K | | | | | | |
| | 5751 - 8500 | NOx | THC | NMHC | CO | PM | MILES | NOx | THC | NMHC | CO | PM | MILES |
| | | — | — | .39 | 5.0 | — | 50K | 1.53 | | .56 | 7.3 | .12 | 120K |
| | | 1.53 | .80 | .56 | 7.3 | .12 | 120K | | | | | | |
| 8501 - 14,000 | 8501- 10,000 | NOx | THC | NMHC | CO | PM | MILES | NOx | THC | NMHC | CO | PM | MILES |
| | | 4.0* | 1.3* | | 15.5* | .10* | 110K | 1.81 | | .66 | 8.1 | .15 | 120K |
| | 10,000 - 14,000 | 4.0* | 1.3* | | 15.5* | | | NOx | THC | THC | CO | PM | MILES |
| | | 4.0* | 1.9* | | 37.7* | | | 2.77 | | .86 | 10.3 | .18 | 120K |
| >14000 | >14000 | NOx | THC | NMHC | CO | PM | MILES | NOx | THC | THC | CO | PM | MILES |
| | | 4.0* | 1.9* | | 37.7* | | | | 3.9* | | 14.4* | .10* | 110K |
| | | | | | | | OPT FOR | DIESEL/INCOMPL.* (GVW 8501-14,000) | | | | | |
| | | | | | | | | NOx & NHM C | | | CO | PM | MILES |
| | | | | | | | | 3.9* | | | 14.4* | .10* | 110K |
| | | | | | | | | * g/bhp - hr | | | | | |

Figure: 4.1.1-I EPA Regulations

#### 4.1.3.1 Onboard Diagnostics

Onboard diagnostic refers to the ability of the Powertrain control system to self diagnose emission performance related problems and communicate the existence of such problems to the vehicle operator via the “Service Engine Soon” telltale light present in the vehicle instrument panel, or to the service technician via a serial data communication tool attached to what has been the Assembly Line Data Link (ALDL), but what is becoming an industry standard “Class 2” serial data link per SAE J1850.

a. Improve in-use compliance with emission standards for the lifetime of the vehicle.

b. Detect & identify deterioration and malfunction of emission related components and systems.

c. Augment/supplant current inspection/maintenance programs.

d. Detect deterioration or malfunction of individual emission related components.

e. Define a standardized electronic communication protocol to enable interrogation of the control system so as to allow independent service stations the ability to diagnose and repair emission related failures with communized electronic instruments across various manufacturer’s product lines.

#### 4.1.3.2 Applicability

Table 4.1.3.2 -1 defines the applicability of Federal OBD II requirements to Federally emission certified full size GMTG vehicles.

| GVWR (Lbs.) | OBDII Compliance Requirements | |
|---|---|---|
| | EPA | California |
| ≤ 8500 Lbs. | yes | yes |
| 8500 ≤ GVWR ≤ 14000 | no | N/a |
| ≥ 14000 Lbs. | N/a | N/a |

Table 4.1.3.2-I. Applicability of Federal/California OBD II Full-Size Vehicles

#### 4.1.3.3 Requirements

Federal OBD II requirements may be categorized into two basic groups. The two groups include:

a. Standardization requirements
b. Diagnostic Requirements specific to Federal OBD II

| Requirement | Description |
|---|---|
| Data Link Connector and Protocol | SAEJ1850 - Specifics requirements for vehicle data communications network. GM implementation of this standard known as Class 2 Serial Data |
| | SAEJ1962 - Specifies the new 16 pin under dash diagnostic connector. |
| | SAEJ1978 - Specifies the OBD II scan tool which is designed to attach and communicate via the under dash diagnostic connector. |
| Test Modes and Fault Codes | SAEJ1979 - Specifies CARB/EPA functions and messages |
| Parameter Information | SAEJ2012 - Specifies format and messages for diagnostic trouble codes |

# 5.0 OPERATING ENVIRONMENT

## 5.1 ROADWAY GRADES, SURFACES AND HAZARDS

The careful selection of 4.3L V6 90 Degree Engine and Transmission in accordance with the proper installation to the vehicle will assure the operation of the engine in a very wide range of roadway grades, surfaces, hazard and Off Road conditions.

Altitude: The engine is designed to function at altitudes from 200ft (61M) below sea level to 14500ft (4420M) above sea level.

Gradability: The engine is designed to function at grades -16<0< 16% GM Application engineering will support the customer with applications out of this range.

## 5.2 CRITICAL COMPONENT TEMPERATURE LIMITS

The following table 5.2 shows Critical Component Temperature Limits as a reference value for different components. The GM application will verify these values for each specific application. All engine non-metallic components not listed in the table will withstand a minimum underhood temperature of 121 Degree Celsius.

| Component | Temperature Range | Excursion Temp (Deg. C) |
|---|---|---|
| Coolant Temperature Sensor | -40 to 132 | 172 |
| Aux. Cooling Fan Switch | -40 to 132 | 172 |
| ESC Sensor | -50 to 135 | 185 |
| Spark Plug Wire Conduit - Nylon | -40 to 120 | 180 |
| Spark Plug Wire Clips - Nylon 66 | -40 to 135 | 200 |
| Spark Plug Wire Boots - Hi Temp Silicone | -40 to 232 | 272 |
| Fuel Injectors | -40 to 120 | 160 |
| MAP Sensors | -40 to 105 | 145 |
| Fuel Rail | -40 to 125 | 165 |
| Coil Driver Module | -40 to 125 | 165 |
| Crank Sensor | -40 to 150 | 165 |
| Oxygen Sensor Connector | -40 to 125 | 165 |
| Starter Motor | -40 to 121 | 161 |
| High Voltage Switch & Internal CAM Sensor | -40 to 150 | 165 |
| ECM Coolant Sensor | -40 to 155 | 195 |
| Ignition Coil | -40 to 105 | 145 |
| MAF sensor | -40 to 125 | 165 |
| Throttle Body | -40 to 120 | 160 |
| Purge Valve | -40 to 125 | 150 |
| Evap. Tube | -40 to 125 | 150 |
| Canister | -40 to 90 | 125 |
| IAT Sensor | -40 to 125 | 165 |
| EGR & Internal | -40 to 135 | 175 |
| Oil Pressure Sensor | -40 to 150 | 190 |
| Ignition Cable | -40 to 232 | 272 |
| Block Heater | -40 to 135 | 175 |
| Bypass Coolant Hose | -40 to 130 | 170 |
| Exhaust Manifold & Components | -40 to 950 | 1100 |
| Underbody Attaching Harnesses/Connectors | -40 to 125 | 165 |
| Transmission to Engine Electrical Connectors | -40 to 135 | 175 |
| Oil Pan Gasket | -40 to 150 | 190 |
| Quick Connect Cooler Fitting Seal | -40 to 150 | 190 |
| Oil Pan Drain Plug Seal | -40 to 150 | 190 |
| NSBU Switch | -40 to 150 | 190 |
| Oil Mineral | -30 to 128 | 150 |
| Belts | -40 to 121 | 121 |

**5.3 HUMIDITY, RELATIVE HUMIDITY (SEE CHART 5.2-I)**

**5.4 PRESSURE (SEE CHART 5.2-I)**
The 4.3L V6 90 Degree Engine shall be able to withstand any combination of environment conditions that it may be exposed to in 10 years.
For the purpose of this application manual the environment is defined as the 4.3L V6 90 Degree Engine exposed during the percentage of his life to the conditions showed in the chart 5.2.1-I.

Table : 5.2.1-I Temperature Operating Environment

| Functionality | Minimum Temperature | Maximum Temperature |
|---|---|---|
| Operate, Start Unassisted | -20 F | 120 F |
| Operate, Start Assisted (1) | -40 F | 135 F |

(1) Assisted starts in the -20 to -40 degree Fahrenheit range shall be interpreted as meaning that the vehicle must start under the defined condition with use of appropriate aids such as an RPO engine block heater, reduced viscosity oil, an auxiliary battery and or battery blanket(s). In the 120 to 135 degree Fahrenheit range an assisted start is defined as permitting a hot engine to cool down to a level at which it will restart.

Chart 6.2.1-I Environment Definitions

The temperature of the different Subsystems configuring the 4.3L V6 90 Degree Engine during operation might be appreciable different from the values indicated in the Chart 5.2.1-I but will never jeopardize the engine performance .See paragraph 5.2 for component max. temperatures.
The GM Application Engineer will define the TBD values in correspondence with the test procedure adopted by the customer.

**5.5 Underhood/Underbody Car Wash**
No actual or projected loss of function or performance of the engine system shall occur as a result of operating the vehicle in a car wash environment.

**5.6 Fording**
Consult the GM Application Engineer for application in conditions during Fording Operations.

**5.7 Sand And Dust Exposure**
No actual or projected loss of function or performance of the engine system shall occur as a result of operating the vehicle in a sandy or dusty environment when the recommended air induction system maintenance is performed.

**5.8 Gravel And Stone Chip Exposure**
No actual or projected loss of function or performance of the engine system shall occur as a result of operating the vehicle in a gravel and stone environment.

**5.9 Ozone exposure**
No actual or projected loss of function or performance of the engine system shall occur as a result of operating the vehicle in an environment with ozone exposure.

**5.10 Electromagnetic Environment**
The 4.3L V6 90 Degree Engine System is tested to ensure that electromagnetic environmental conditions would not interfere with engine performance.

**5.11 Shock, Impact**
During the course of the normal operating life of the vehicle, the engine may be exposed to shock loading. The engine, when installed in the vehicle, will be able to withstand the following G forces. These are considered as random singular occurrences and are not cyclic.
a. Vertical - 2g's, b. Fore-Aft - 6g's, c. Lateral - 2g's.

**5.12 Vibration Powertrain Bending**

Powertrain Bending is a source of low frequency noise (50-200 Hz) which results in vibration. Powertrain bending is defined as the point of the powertrain's first vertical or horizontal bending. In the case of the 4.3L V6 90 Degree Engine, the 2nd and 3rd orders of vibration are considered. The low frequency vibration generated by Powertrain bending can be transmitted through the mounts and into the frame and body of the vehicle.

This induced energy can cause vibration of vehicle components, which set up objectionable resonance for the driver and passengers. For this reason, it is desired to make the Powertrain package stiff enough so the Powertrain bending occurs at an engine RPM outside of the normal operating mode or driving conditions of the vehicle. The ideal situation is to target the powertrain's bending moment so it occurs past the engine's maximum RPM.

The minimum Powertrain stiffness as measured in units of Hertz to accomplish this can be determined from the following equation:

$$\text{Min. Bending Frequency (Hz)} = \frac{(\text{Constant *}) \times (\text{RPM Max. Rated})}{60 \text{ sec.}}$$

* Use constant from table 6.12.1-I.

Table 6.12.1-I. Significant Orders of Vibration

| Engine Configuration | Orders of Vibration | Constant * |
|---|---|---|
| L4 | 2nd Order | 2 |
| V6 - 60° | 2nd Order | 2 |
| V6 - 90° | 2nd Order | 2 |
| V6 - L6 | 3rd Order | 3 |
| V8 - 90° | 1st Order | 1 |
| V8 - 90° | 1-1/2 Order | 1.5 |
| V8 - 90° | 4th Order | 4 |

Example: a. 4.3L V6 90 Degree Engine $= \frac{(2) \times (5000 \text{ RPM})}{60 \text{ sec.}} = 166$ Hz Bending Frequency

In the case of a 4.3L V6 90 Degree Engine, it is desired to have the Powertrain stiffness great enough so the bending resonance occurs at or above 90 Hz when the Powertrain is installed in the vehicle. If the 4th order of vibration is considered, it is necessary to move the bending resonance out past 240 Hz to assure no resonance occurs within the engine operating speed. Since this is impractical because of the design of the engine block and transmission housing, it is desirable to tailor the component design so the bending resonance does not occur at idle or between 1800 and 2500 RPM. See GM Application Engineer for further analysis.

# 6.0 RECOMMENDED USAGE CONSTRAINTS

The following defines the outer limits of the envelope of operation that this engine has been validated to (for its original application). Due to the extreme variation of potential usages, the attached information should only be used as a guide toward pursuing alternate applications. Operation "outside" of the described envelope should not be attempted without extensive testing and guidance from product engineering. Data monitoring and providing shutdown capability would provide additional assurance that the application's intended envelope is not violated. The following parameters warrant measurement consideration.

- Engine Speed -PCM controlled and monitored- Dash Light Sign
- Oil Temperature -Dash Light Sign
- Coolant Temperature -PCM controlled and monitored- Dash Light Sign
- Coolant Level -Dash Light Sign

## 6.1 ENGINE PRE-CONDITIONING PRIOR TO NORMAL OPERATION

No towing or continuous WOT operations for the first 500 miles or 12 hours.

## 6.2 ENGINE SPEED

Engine speed range has the ability to impact vehicle fuel economy, durability, and driveability performance, particularly under heavy load.
The engine will provide the following speed dynamic range values shown in Table 2.2.3-II.

### 6.2.2 Maximum Start Time.

Engine start time is directly affected by the design of the starting subsystem. The starting subsystem parameters include starter efficiency, battery cable length, battery cable gauge, corrosion resistance and conductivity of cable connectors and battery cold cranking capacity. The vehicle will start within the maximum times specified in Table 6.2.2 -I and continue to run at idle.

| Table 6.2.2-I Maximum Start Time by Temperature | |
|---|---|
| 120 to 0 F | 1 sec. |
| 0 to -20 F | 2 sec. |

Table 6.2.2 -I 4.3L V6 90 Degree Engine Cranking

For temperature operating environment see table 5.2.1-I.
All starting times require at least 80% battery charge.
A starting aid (block heater) is required below -20°F.
Ignition voltage to PCM must be maintained at or above 7 volts during cranking.

### 6.2.3 Idle Quality (Speed and Stability)

#### 6.2.3.1 Idle Stability

The PCM algorithm modifies fuel pulse and engine parameters to create smooth engine idling at the values specified by the application engineer.

#### 6.2.3.2 Idle Speed

The idle speed selected shall comprehend other subsystem requirements (i.e. cooling, electrical, noise, accessory drive, etc. and be developed in the vehicle).
The engine idle speed will be targeted at the values shown in table 6.2.3.2-I to minimize fuel consumption and emissions.

| Engine Speed Condition | L35 |
|---|---|
| Idle Speed - Auto Transmission | 575 rpm |
| Idle Speed - Manual Transmission | 525 rpm |
| Maximum Upshift | 5200 rpm |
| Maximum Upshift Hysteresis | 5200 rpm |

Table 6.2.3.2 -I V 6 Speed Dynamic Range

a) Operation at normal operating coolant temperature ( Range : 80 -128 ∞C)

| | |
|---|---|
| Maximum Transient (W.O.T.) | 5200 RPM |
| Minimum Transient (W.O.T.) | 600 RPM |
| Instantaneous Maximum | 5200 RPM |
| Continuous Maximum | 4600 RPM |

b) Operation at cold coolant temperature

| | |
|---|---|
| Maximum @ - 28°C | 4600 RPM |

c) Operation at hot coolant temperature

| | |
|---|---|
| Maximum @ 128°C | 4600 RPM |

**6.3 ENGINE LOAD**

Sustained high engine loads (loads in excess of 90% of W.O. T. torque) should not be applied below peak torque - engine rpm, See paragraph 2.3.2.1.

Torque Fluctuations.

Torque Fluctuations at WOT, will not exceed a value of ± 5% of the nominal torque value between 1000 RPM & max. rated speed.

Brake Specific Fuel Consumption

The engine brake specific fuel consumption (bsfc) shall be as follows:

1. The engines nominal brake specific fuel consumption point on a W.O.T. curve is shown in table 6.3 -I.
2. The engine nominal specific fuel consumption shown in table 7.3 -I are for an operating range between peak torque and maximum power at full load.
3. The engines best part throttle bsfc (on a fuel map) is shown in table 7.3 -I.

| **RPM** | **L35** Truck Applications | **L35** Marine Applications | **Notes** |
|---|---|---|---|
| 800 | 0.529 | 0.495 | lb./BHP-Hr |
| 1200 | 0.521 | 0.478 | lb./BHP-Hr |
| 1600 | 0.484 | 0.481 | lb./BHP-Hr |
| 2000 | 0.470 | 0.471 | lb./BHP-Hr |
| 2400 | 0.471 | 0.466 | lb./BHP-Hr |
| 2800 | 0.469 | 0.472 | lb./BHP-Hr |
| 3200 | 0.478 | 0.458 | lb./BHP-Hr |
| 3600 | 0.483 | 0.452 | lb./BHP-Hr |
| 4000 | 0.500 | 0.460 | lb./BHP-Hr |
| 4400 | 0.525 | 0.479 | lb./BHP-Hr |
| 4800 | 0.532 | 0.506 | lb./BHP-Hr |
| 5200 | 0.556 | 0.550 | lb./BHP-Hr |

Table 6.3 -I V6 4.3L Engine BSFC

Engine Brake Capacity

FMVSS requires engine braking in at least one of the lower ratios, below 25mph.
For a transmission type similar to the 4L60-E this is equivalent to 2nd gear. For another type of transmission combination the braking capability should be verified.
For manual transmissions, engine braking is calibrated with the GM transmissions to occur in the highest ratio in each forward selector range
Some off road applications or very heavy load situations might require additional subsystems to increase engine brake capacity.
Depending on the application, the GM release engineer and the customer will determine the necessity of auxiliary or additional engine brake aid sub systems.

**6.4 OIL & CRANKCASE VENTILATION**
Ambient Operating Temperature
-30°C to 128°C:use SAE 5W-30

Oil Quality: Use oil that meets the CF-2 quality standards of the API
Crankcase Ventilation
PCV Positive Crankcase Ventilation is used in the 4.3L V6 90 Degree.

**6.5 COOLANT:**
Coolant (See 3.5 Cooling/Heater)
Ethylene Glycol water mix 52/48 (normal) up to maximum of 60% glycol, 40% water
Coolant Temperature: See Section 3.5
Coolant Pressure: See Section 3.5
Warm-Up Rate: See Section 2.3.2.3.4

**6.6 COMBUSTION CONTROL**
All combustion controlled parameters are adjusted automatically through the PCM

**7.0 QUALITY, RELIABILITY, & DURABILITY (QRD)**

**7.1 QUALITY AND RELIABILITY**

Minimum Level of warranty is 12 month and 12000 miles, but there are available alternative warranty plans throughout the GMPT and GM Service Group.

**7.2 DURABILITY - USEFUL LIFE**

| Useful Life Definition | | |
|---|---|---|
| Usage | Mileage | Years |
| 4.3L (Light Duty) Unleaded Fuel | 120,000 | 10 |

# 8.0 SERVICE REQUIREMENTS

## 8.1 MAINTENANCE SCHEDULES (SEVERE USAGE AND NON SEVERE USAGE).

There are two maintenance schedules applicable to the 4.3L V6 90 Degree Engine.
These maintenance schedules relate to severe usage and non-severe usage.

### 8.1.1 Maintenance Schedules - Severe Usage (Schedule I)

Severe usage or short trip/city shall continue to be defined by the following description of typical operation in the vehicle's owner's manual:

- Most trips are less than 4 miles (6km);
- Most trips are less than 10 miles (16km), and the ambient temperature is below freezing
- The engine is at low speed most of the time (door to door delivery, stop and go traffic, commercial use)
- The vehicle is operated in dusty areas or off road frequently;
- The vehicle is used to tow a trailer

### 8.1.2 Maintenance Schedule - Non Severe or Long Trip/Highway Usage (Schedule II)

Long trip/highway shall continue to be defined in the vehicle owner's manual as all typical vehicle usage not defined to be included in the severe usage schedule.

## 8.2 SERVICE INTERVAL BY SCHEDULE

The service intervals for engine related service are defined in Table 8.2 - 1 as a function of vehicle usage category, i.e. short trip/city usage or long trip/ highway usage.

**Table : 8.2 - I Routine Service Interval by Usage**

| Item | Schedule I (<8500 GVWR) | Schedule II (<8500 GVWR) | Schedule 1 (>8500 GVWR) | Schedule II (>8500 GVWR) |
|---|---|---|---|---|
| Engine Oil and Filter | 3000 miles/3 month Or on condition detected by oil quality monitoring system | 7500 miles/12months Or on condition detected by oil quality monitoring system | 3000 miles/3 month Or on condition detected by oil quality monitoring system | 7500 miles/12months Or on condition detected by oil quality monitoring system |
| Engine Coolant | 50000 miles | 50000 miles | 50000 miles | 50000 miles |
| Air Cleaner Filter | 30000 miles | 30000 miles | 24000 miles | 24000 miles |
| Spark Plug | 100000 miles | 100000 miles | 100000 miles | 100000 miles |
| Engine Wire ASM | 100000 miles | 100000 miles | 100000 miles | 100000 miles |
| Accessory Drive Belt | 100000 miles | 100000 miles | 100000 miles | 100000 miles |

# 9.0 DIAGNOSTICS

*Diagnosis shall be accomplished using industry standard electronic diagnosis tools such as Techline Equipment (Tech 1/Tech 2 / Tech XS / CAMS).*

# 10.0 OTHER AVAILABLE DOCUMENTS

*The Application engineer will supply all technical documents needed to support the application and validation process.*

# 11.0 VALIDATION REQUIREMENTS

## 11.1 GENERAL

The validation of GM Powertrain units may follow a wide variety of validation procedures. GMPT will participate with the customer in establishing the validation procedure needed to validate the application of the V6 Gasoline Engine into the customer vehicle.

## 11.2 METHODS

When required, The GM Application and the Customer Release Engineer will determine a method of design validation from the four acceptable methods listed below.

A: Validation by Analysis:
1) *Simulation* of the product (or its functions) or manufacturing process and the specified conditions *using mathematical representation* (math models, algorithms, equations, etc.), in accordance with a procedure, and documenting the results to ensure that a particular requirement has been met.
2) The generation of conclusions through the *examination of known data* to ensure that a particular requirement has been met.

I: Validation by Inspection: *Examination* of the product or manufacturing process, in accordance with a procedure, and documenting specified *physical characteristics* to ensure that a particular requirement has been met.

D: Validation by Demonstration: *Exercising* the product or manufacturing process under specified conditions, in accordance with a procedure, and documenting the results to ensure that a particular requirement has been met.

T: Validation by Test: *Exercising* the product or manufacturing process under specified conditions, in accordance with a procedure, *collecting quantitative data via instrumentation* and documenting the results to ensure that a particular requirement has been met.

## 11.3 VALIDATION DETAILS

Inspection and testing will be required to demonstrate that each V6 Gasoline Engine application is adequate for the duty cycle and life demanded by the end user. This will take place as part of the initial release process, and for significant changes to either the engine, transmission or vehicle systems. Validation Methods of each application of the V6 4.3L Gasoline Engine will be applied at minimum to the following issues:

### 11.3.1 Installation Review

The installation of the engine shall be validated and verified by comparison with the engineering drawings created by vehicle manufacturer.

### 11.3.2 Emissions Test

To be negotiated between GM and Customer

### 11.3.3 Cooling System Performance Test

Cooling Subsystem Performance Test must be approved by the GM application engineer.

### 11.3.4 Water Snow Inhalation Performance Test

Test shall be performed to verify water and or snow can not be ingested by the engine.

### 11.3.5 Design Review/ Mockup

During the design installation process of the V6 Gasoline Engine into a vehicle, the GM Application Engineer will indicate those areas that need design validation prior to construction.

**11.3.6 Underhood Temperature Measurements and Locations**
Locations and Results performed by vehicle manufacturer shall be supplied to GMPT Application Engineer

**11.3.14 On Road Vehicle Test**
This test will reflects performance requirements for speed, load, torque, power, and performance of cooling system.
GMPT Application Engineer will provide vehicle level test specifications to the vehicle manufacturer.
The vehicle manufacturer will execute physical test and provide test results approval by GMPT Application Engineer.

# 12.0 NOTES

## 12.1 ACRONYMS, ABBREVIATIONS, AND SYMBOLS

| | |
|---|---|
| adv | advance |
| A/F | Air -Fuel ratio |
| AIR | Air Injection Reaction |
| ASTM | American Society for Testing Materials |
| API | American Petroleum Institute |
| ATDC | after top dead center |
| avg | average |
| ACG | Allied Component Group |
| B | barometric pressure |
| BMEP | brake mean effective pressure |
| BP | brake power |
| BSFC | brake specific fuel |
| BSHC | brake specific hydrocarbons |
| BSHR | brake specific heat rejection |
| BSCO | brake specific Carbon Monoxide |
| BSPM | brake specific Particulate Mass |
| BSNOx | brake specific NOx (oxides of nitrogen) |
| BTDC | before top dead center |
| E | engine displacement |
| ECM | Electronic Control Unit |
| econ | economy |
| EEC | European Economic Community |
| EFE | Early Fuel Evaporation |
| eff | efficiency |
| EFI | Electronic Fuel Injection |
| EGR | Exhaust Gas Recirculation |
| EPA | Environmental Protection Agency |
| ESC | Electronic Spark Control |
| exh | Exhaust |
| exp | experimental |
| FMEP | Friction Mean Effective Pressure |
| FP | Friction Power |
| FESM | Front End Sheet Metal |
| FMVSS | Federal Motor Vehicle Safety Standards |
| GM | General Motors |
| GMPT | General Motors Powertrain |
| GMTG | General Motors Truck Group |
| GPA | Gas Processors Association Program |
| GVWR | Gross Vehicle Weight Rating |
| GMUTS | General Motors Uniform Test Specifications |
| GPH | Gallons Per Hour |
| HC | hydrocarbon |
| H/C | Hydrogen-Carbon ratio |
| Hz | Hertz (frequency) |
| IPTV | Initial Defects Per Thousand Vehicle |
| IAC | Idle Air Control |
| ID | inside diameter |
| IMEP | Indicated Mean Effective Pressure |
| int | Intake |
| IP | Indicated Power |
| ISC | Idle Speed Control |
| ISO | Interl. Orgn. for Standardization |
| KT | Knock threshold |
| CAD | Computer Aided Design |
| CFR | Cooperative Fuel Research |
| COE | Council of Expertise |
| Corr | corrected |
| COV | coefficient of variation |
| CR | compression ratio |
| CReff | effective compression ratio |
| Cyl | cylinder |
| CEA | Change Engineering Authorization |
| CNG | Compressed Natural Gas |
| D | density |
| Deg | Degree |
| Dia | diameter |
| N | polytropic compression coefficient |
| N | Engine Speed |
| N2 | Nitrogen |
| NAO | North American Operations |
| N/V | Engine Speed/Vehicle Speed |
| NMEP | Net Mean Effective Pressure |
| NMOG | Non Methane Organic Gas |
| No. | number |
| Obs | observed |
| O/C | Oxygen-Carbon ratio |
| OD | outside diameter |
| P | Power |
| PCV | Positive Crankcase Ventilation |
| PFI | Port Fuel Injection |
| PMEP | Pumping Mean Effective Pressure |
| PN | Part Number |
| PON | Pump Octane Number |
| PP | Peak Pressure |
| PT | Part Throttle |
| PCM | Powertrain Control Module |
| P/S | Power Steering |
| PTO | Power Take-Off |
| QFD | Quality Function Deployment |
| R | Torque Scale Arm |
| RAT | Radial Aperture Tube |
| Rev | revolution |
| RLP | Road Load Power |
| RON | Research Octane Number |
| RPO | Regular Production Option |
| RTD | Resistive Temperature Detector |
| RVP | Reid Vapor Pressure |
| RPM | Revolutions Per Minute |

| | |
|---|---|
| L | stabilized dynamometer load |
| LBT | Leanest Mixture for Best Torque |
| LFE | Laminar Flow Element |
| LPG | Liquefied Petroleum Gas |
| LPP | Location of Peak Pressure |
| MAP | Manifold Absolute Pressure |
| max | maximum |
| MBT | Minimum Spark Advance for Best Torque |
| ME | Mechanical Efficiency |
| MEP | Mean Effective Pressure |
| m(a) | air mass flow rate |
| m(f) | fuel mass flow rate |
| MMEP | motoring Mean Effective Pressure |
| MON | Motor Octane Number |
| MT | Motoring Torque |
| MIL | Malfunction Indicator Lamp |
| VTS | Vehicle Technical Specification |
| VDP | Vehicle Development Process (4-Phase) |
| VCM | Vehicle Control Module |
| VE | Volumetric Efficiency |
| WOT | Wide Open Throttle |
| WVRM | World Vehicle Regulation Manual |
| SAE | Society of Automotive Engineers |
| ser no. | serial number |
| sg | specific gravity |
| SI | International System of Units |
| std | standard |
| SSTS | Subsystem Technical Specification |
| T | Torque |
| TBI | Throttle Body Injection |
| TDC | Top Dead Center |
| TPS | Throttle Position Sensor |
| TM | Torque Management |
| TWO | Test Work Order |

## APPENDIX I

| Engine-Vehicle Definition Form | | | | UNITS |
|---|---|---|---|---|
| **VEHICLE PERFORMANCE REQUIREMENTS** | | | | |
| | | | | |
| Maximum Speed on 1st Gear | | | | mph |
| Maximum Speed on 2nd Gear | | | | mph |
| Maximum Speed on 3rd Gear | | | | mph |
| Maximum Speed on 4th Gear | | | | mph |
| Maximum Speed on 5th Gear | | | | mph |
| Maximum Speed on Highway | | | | Mph |
| | | | | |
| Body type | | | | |
| Body Cx | | | | |
| Body Width | | | | Ft |
| Body Height | | | | Ft |
| Body Length | | | | Ft |
| Body Frontal Area | | | | Sq. ft |
| | | | | |
| Curb Weight | | | | Lbs |
| Gross Weight | | | | Lbs |
| **Total weight** | | | | Lbs |
| | | | | |
| Maximum Acceleration (0-60mph) | | | | |
| Maximum Gradient | | | | % |
| | | | | |
| **CHASSIS** | | | | |
| | | | | |
| Single Axle Single Speed Ratio | | | | |
| Single Axle Double Speed - Low Ratio | | | | |
| Single Axle Double Speed - High Ratio | | | | |
| Tandem Axle Single Speed Ratio | | | | |
| Tandem Axle Double Speed - Low Ratio | | | | |
| Tandem Axle Double Speed - High Ratio | | | | |
| | | | | |
| Driveline Efficiency | | | | |
| | | | | |
| Single Axle Single Speed | | | | |
| Single Axle Double Speed | | | | |
| Tandem Axle Single Speed | | | | |
| Tandem Axle Double Speed | | | | |
| | | | | |
| Wheelbase | | | | in |
| Tire Specification | | | | |
| Tire Footprint Development | | | | ft |
| Tire Maximum Speed | | | | rpm |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| **Engine-Vehicle Definition Form** | | | | **UNITS** |
|---|---|---|---|---|
| | | | | |
| **TRANSMISSION** | | | | |
| Manual transmission | | | | |
| 1st Gear Ratio | | | | |
| 2nd Gear Ratio | | | | |
| 3rd Gear Ratio | | | | |
| 4th Gear Ratio | | | | |
| 5th Gear Ratio | | | | |
| 6th Gear Ratio | | | | |
| | | | | |
| Automatic transmission | | | | |
| 1st Gear Ratio | | | | |
| 2nd Gear Ratio | | | | |
| 3rd Gear Ratio | | | | |
| 4th Gear Ratio | | | | |
| 5th Gear Ratio | | | | |
| 6th Gear Ratio | | | | |
| Accessories | | | | |
| Accessory #1: | | | | |
| Accessory #1 Location: | | | | |
| Accessory #1 Type Drive: | | | | |
| Accessory #1 Hp required: | | | | |
| | | | | |
| Accessory #2: | | | | |
| Accessory #2 Location: | | | | |
| Accessory #2 Type Drive: | | | | |
| Accessory #2 Hp required: | | | | |
| | | | | |
| Accessory #3: | | | | |
| Accessory #3 Location: | | | | |
| Accessory #3 Type Drive: | | | | |
| Accessory #3 Hp required: | | | | |
| | | | | |
| Accessory #4: | | | | |
| Accessory #4 Location: | | | | |
| Accessory #4 Type Drive: | | | | |
| Accessory #4 Hp required: | | | | |
| | | | | |
| **Vehicle Power & Torque Requirements For Maximum Grade Speed (MPH)** | **Rolling Power Requirements K W V (1+ f)/ 375 hp** | **Grade Power Requirements G W V / 375 (100) hp** | **Aerodyn. Power Requirements 0.00256 C A V³ hp** | **Total Power Hp** |
| 10 | | | | |
| 15 | | | | |
| 20 | | | | |
| 25 | | | | |
| 30 | | | | |
| 35 | | | | |
| 40 | | | | |
| 45 | | | | |
| Power for maximum Grade | | | | |
| Torque for maximum Grade | | | | |
| | | | | |
| | | | | |

| **Engine-Vehicle Definition Form** | | | | **UNITS** |
|---|---|---|---|---|
| | | | | |
| **TRANSMISSION** | | | | |
| Manual transmission | | | | |
| 1st Gear Ratio | | | | |
| 2nd Gear Ratio | | | | |
| 3rd Gear Ratio | | | | |
| 4th Gear Ratio | | | | |
| 5th Gear Ratio | | | | |
| 6th Gear Ratio | | | | |
| | | | | |
| Automatic transmission | | | | |
| 1st Gear Ratio | | | | |
| 2nd Gear Ratio | | | | |
| 3rd Gear Ratio | | | | |
| 4th Gear Ratio | | | | |
| 5th Gear Ratio | | | | |
| 6th Gear Ratio | | | | |
| Accessories | | | | |
| Accessory #1: | | | | |
| Accessory #1 Location: | | | | |
| Accessory #1 Type Drive: | | | | |
| Accessory #1 Hp required: | | | | |
| | | | | |
| Accessory #2: | | | | |
| Accessory #2 Location: | | | | |
| Accessory #2 Type Drive: | | | | |
| Accessory #2 Hp required: | | | | |
| | | | | |
| Accessory #3: | | | | |
| Accessory #3 Location: | | | | |
| Accessory #3 Type Drive: | | | | |
| Accessory #3 Hp required: | | | | |
| | | | | |
| Accessory #4: | | | | |
| Accessory #4 Location: | | | | |
| Accessory #4 Type Drive: | | | | |
| Accessory #4 Hp required: | | | | |
| | | | | |
| **Vehicle Power & Torque Requirements For Maximum Grade Speed (MPH)** | **Rolling Power Requirements K W V (1+ f)/ 375 hp** | **Grade Power Requirements G W V / 375 (100) hp** | **Aerodyn. Power Requirements 0.00256 C A V³ hp** | **Total Power Hp** |
| 10 | | | | |
| 15 | | | | |
| 20 | | | | |
| 25 | | | | |
| 30 | | | | |
| 35 | | | | |
| 40 | | | | |
| 45 | | | | |
| Power for maximum Grade | | | | |
| Torque for maximum Grade | | | | |
| | | | | |
| | | | | |

| **Engine-Vehicle Definition Form** | | | | **UNITS** |
|---|---|---|---|---|
| | | | | |
| **Vehicle Power & Torque Requirements For Maximum Speed Speed (MPH)** | **Rolling Power Requirements K W V (1+ f)/ 375 hp** | **Grade Power Requirements G W V / 375 (100) hp** | **Aerodyn. Power Requirements 0.00256 C A $V^3$ hp** | **Total Power hp** |
| **10** | | | | |
| **20** | | | | |
| **30** | | | | |
| **40** | | | | |
| **50** | | | | |
| **60** | | | | |
| **70** | | | | |
| **80** | | | | |
| **90** | | | | |
| **100** | | | | |
| Power for maximum Speed | | | | |
| Torque for maximum Speed | | | | |
| | | | | |
| Vehicle Cooling System | | | | |
| Radiator: | Make: | M/N # : | P/N: | |
| Size: | Height: | Width: | Thickness: | |
| Number of Rows of Tubes: | Fins/In. | | | |
| Minimum Radiator Frontal Area | | | | Sq. Meter |
| Radiator Total Area | | | | Sq. Meter |
| Radiator Heat Evacuation Capacity | | | | BTU/Min |
| Maximum Radiator Coolant Flow | | | | GPM |
| Maximum Radiator Peak Pressure | | | | bar |
| Radiator Coolant inlet Size | | | | mm |
| Radiator Coolant Outlet Size | | | | mm |
| Surge Tank | Make: | M/N # : | Location: | |
| | Capacity: | Hose Size: | | |
| Deareation Tank | Make: | M/N # : | Location: | |
| | Capacity: | Hose Size: | | |
| Recovery Bottle | Make: | M/N # : | Location: | |
| | Capacity: | Hose Size: | | |
| Low Coolant Sensor Type | | | | |
| Low Coolant Sensor Location | | | | |
| Describe Deareation System: | Lines Sizes: | Location: | | |
| Describe obstruction to water flow: | | | | |
| Vehicle Heater Core: | Make: | Type: | Location: | |
| Auxiliary Heaters: | Make: | Type: | Location: | |
| Shutoff or By-Pass Valve: | | | | |
| Air Bleeds: | | | | Sq. Meter |
| Heater Hose Routing: | | | | Sq. Meter |
| Fan | Make: | M/N#: | Max. Speed: | |
| Fan Type: | | | | |
| Fan Drive | Solid/Viscous | Clutch: | Drive Ratio: | |
| Suction / Blower Diameter | Blades # | | | |
| | | | | |
| Vehicle Electrical System | | | | |
| Battery | Make: | M/N # : | Location: | |
| | Voltage | Amperage | | Ambient |
| | Voltage | Amperage | | Cold |
| | | | | |

| Engine-Vehicle Definition Form | | | | UNITS |
|---|---|---|---|---|
| | | | | |
| Alternator | Make: | M/N # : | Location: | Nominal |
| | Voltage | Amperage | | |
| Starter | Make: | M/N # : | Location: | Nominal |
| | Power: | Amperage: | | |
| | | | | |
| **Vehicle Oil System** | | | | |
| Remote Filter: | Type: | Capacity: | | |
| Location & Measured height relative to bottom of cylinder block | | | | |
| | | | | |
| **Oil Radiator Capacity** | | | | |
| Radiator Number of Rows | | | | |
| Radiator Number of Tubes | | | | |
| Minimum Radiator Frontal Area | | | | Sq. Meter |
| Radiator Total Area | | | | Sq. Meter |
| Radiator Heat Evacuation Capacity | | | | BTU/Min |
| Maximum Radiator Coolant Flow | | | | GPM |
| Maximum Radiator Peak Pressure | | | | bar |
| Radiator Coolant inlet Size | | | | mm |
| Radiator Coolant Outlet Size | | | | mm |
| | | | | |
| **Vehicle Fuel System** | | | | |
| Fuel Tank | Material: | Type: | Capacity: | |
| Fuel Lines Inlet | Size: | Length; | Material: | |
| Fuel Lines Return | Size: | Length; | Material: | |
| Height of Fuel Tank to Fuel Pump | | | | |
| Fuel Tank Cap Relief Pressure | | | | |
| **Fuel Supply Pump** | | | | |
| Type | Make: | Pressure: | Flow: | |
| Inlet Restriction @ Pump | | | | |
| Additional Comments | | | | |
| **Air System** | | | | |
| Air Cleaner | Make: | Type: | Model: | |
| Cleaner location | Size: | Length: | Material: | |
| Air Inlet Restriction | @FL/NL: | | | |
| | | | | |
| **Vehicle Exhaust System** | | | | |
| Type : Single/Dual Pipe | Size: | Material: | Make: | |
| Muffler: | Size: | Material: | Make: | |
| Muffler/ Pipe Connection: | Location: | Flex / Solid: | | |
| Catalytic Converter | Size: | Material: | Make: | |
| | @FL/NL: | Location: | | |
| Exhaust Back Pressure | @FL/NL: | Location: | | |

# PREFACE

This document will assist the reader in the application of the 4.3L V6 90 Degree Engine to the vehicle.

It gives an overview of the engine, its features, as well as focus on the systems, subsystems and attachments that interface between the engine and the vehicle.

The performance of the 4.3L V6 90 Degree Engine is dependent on the design and processing of the interface systems and their components.

Definitions:

The number between bracket shows the Specification level.

VTS: Vehicle Technical Specification. Level (1) SSTS.

Powertrain SSTS: Powertrain Subsystem Technical Specification. Level (2) SSTS.

Composed of Engine, Transmission and Controls, Similar to the other NAO Major Technical Subsystems, like Electrical, HVAC, Chassis, Body, etc.

Engine SSTS: Engine Subsystem Technical Specification. Level (3) SSTS.

Transmission SSTS: Transmission Subsystem Technical Specification. Level (3) SSTS.

Controls SSTS: Controls Subsystem Technical Specification. Level (3) SSTS.

Cylinder Head SSTS: Cylinder Head Subsystem Technical Specification. Level (4) SSTS.

Piston CTS: Piston Component Technical Specification. Level (5) SSTS.

ACE: Assistant Chief Engineer, AE: Application Engineer, DRE: Design Release Engineer, PTVSE: Powertrain Vehicle System Engineer.

The Word Subsystem is used in this context to indicate that a System Level (2) is part of a major System Level (1).

The diagram 1.1 - I shows the scope of this specification with a dot line around the subsystems in which it place precedence.

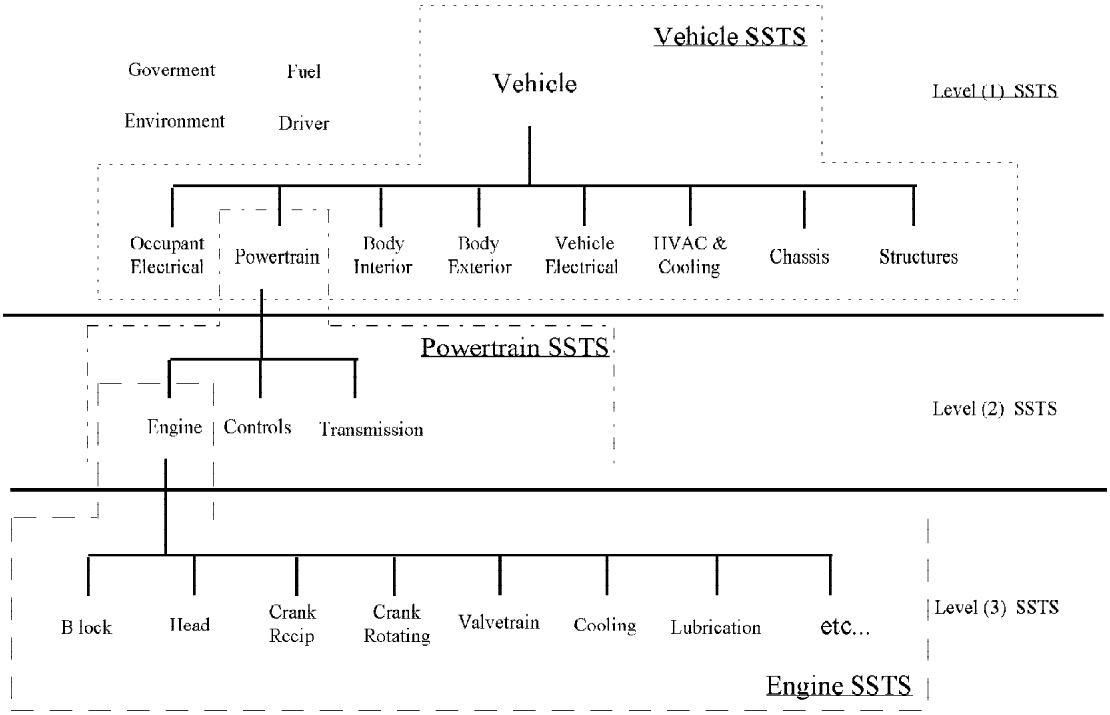



Diagram 1.1-I Powertrain SSTS scope of work

GM Powertrain needs a thorough understanding of each application for the 4.3L V6 90 Degree Engine, including for example, vehicle mass, transmission performance details, vehicle speed and grade as well as vehicle cooling and air intake capabilities.

The OEM customer shall submit a completed " Model Definition Form", supplied by GM Powertrain at the start of each project or equivalent " Vehicle Powertrain Technical Requirement Specification" for each project.
A sample form of the former appears as a supplement to this manual. (See Appendix I)
This data from the Model Definition Form, and the requirements contained within this manual, will be used to generate an agreed specification for the complete 4.3L V6 90 Degree Engine.

All the dimensions and values in this manual are for reference only.
Refer to the appropriate 4.3L V6 90 Degree Engine installation drawing(s) for definitive information.

The following table summarizes the organization of the document.

| Section | Comments |
|---|---|
| 1.0 Introduction | |
| 2.0 Product Summary | Summarizes the Product Information, Provides Feature Location Illustrations, and Characterizes the Engine Content as Delivered. |
| 3.0 Major System and Interface Descriptions | Provides the "context" the Engine Operates Within. |
| 4.0 Vehicle Mounting and Packaging | Details Mounting and Packaging. |
| 5.0 Detailed Performance Description | Provides Details on the Performance of the Engine as an Overall System. |
| 6.0 Operating Environment | Details the Intended Operating Environment. |
| 7.0 Recommended Usage Constraints | Provides Cautions and Limits for Intended Usage. |
| 8.0 Quality, Reliability, and Durability | Details Design Intent QRD Performance. |
| 9.0 Service Requirements | Details Service Intervals and Service Parts. |
| 10.0 Diagnostics | Details Supported Diagnostics and Procedures |
| 11.0 Other Available Documents | Provides References to Related Documentation. |
| 12.0 Validation Requirements | Details Validation processes |
| 13.0 Notes | Defines Terms used in Manual. |
| Appendix I | Engine – Vehicle Definition Form |

**TEMPLATE OWNERS**

| **Name** | Gasoline 4.3L V6 90 Degree Team : **Title/Affiliation** | **Date Approved** |
|---|---|---|
| Ron Meegan | GMPT Total Integration Engineer L35 | |
| Frank Tenkel | GMPT Application Engineering | |
| Luis Nespolo | GMPT Application Engineering | |
| Jeremy Worm | GMPT System Engineering | |
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## REVISION LOG

| **Revision Date** | **Document ID** | **Revision Description** | **Paragraphs Affected** |
|---|---|---|---|
| 7/21/00 | Engine Application Manual 2001 4.3L V6 90Degree | Revision 0 - Document Issued | All |
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